A McGraw-Hill Publication

Journal of Electricity and Western Industry

February 1, 1921 San Francisco

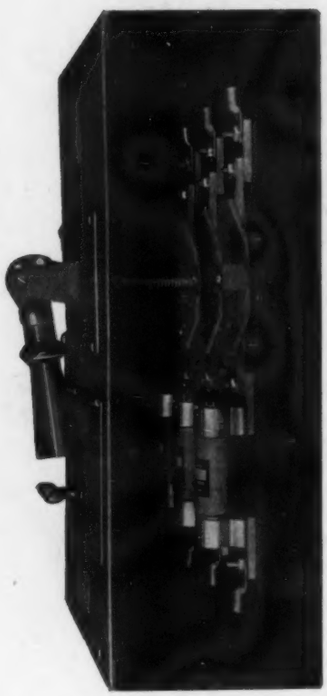
THE unlocking of the forty million hydroelectric horsepower in the West is a direct result of the development of high head hydraulic turbines. An outstanding example is the installation of two 22,500 hp., 802 foot head PELTON reaction turbines, shown above, in the Kern River Number 3 Plant, Southern California Edison Company, the highest head reaction turbines ever constructed.

The Pelton Water Wheel Company maintains offices at 1991 Harrison Street, San Francisco, and 91 West Street, New York, and is the western representative of the M. W. Kellogg Company, manufacturers of hammer welded pressure pipe.

A Western Product

Switch in closed position. Access to live fuses impossible—except for testing. See Point No. 3.

UNIT
SAFETY SWITCH



Open side view of switch in closed position. Showing simple construction.

Fourteen Points of

1

Absolute safety — operating handle folding over fuse door serves as a simple yet positive Safety Interlock. Fuse door cannot be opened until the switch is in "OFF" position.

2

No live contacts are accessible when fuse door is open.

3

For testing purposes, operating handle removable, giving access to live fuses by authorized persons. An interlock is of no value which prevents testing.

4

Switch cannot be left in partial contact or in any intermediate position between full "ON" or full "OFF." Simple cam movement insures positive action.

5

Laminated wiping contacts with wedge-shaped solid blades, under constant pressure insures always positive contact.

6

Two simultaneous quick breaks in pole reduces arcing and increases life of switch.

The UNIT Safety Switch is *Really*

Manufactured by

UNIT ELECTRIC COMPANY

450-460 Natoma St. **San Francisco, Calif.**

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Contents

EDITORIALS 103

"Journal of Electricity and Western Industry"—New Industrial Electrical Inspection—Electrification of the Coal Mines—The Electrical Show Promoter—Quality—Public Ownership or Customer Ownership—Engineering Advice on the Income Tax—Development of Power in National Parks—Conservation of Forest Products.

THE MOTOR MARKET ON THE PACIFIC COAST 110

An analysis of the rapidly increasing motor load of the Pacific Coast as indicative of the industrial expansion of the district, and the increased application of electricity to industrial processes.

ELECTRICITY IN THE LUMBER INDUSTRY — by E. F. Whitney and W. C. Heston 114

The lumber industry of the Northwest has been revolutionized by electricity. This article reviews recent progress and outlines further possibilities for increasing efficiency and output.

TENDENCIES IN DEVELOPMENT OF HYDRAULIC PRIME MOVERS — by S. L. Shuffleton 116

An authoritative and interesting account of one of the most fundamental factors in Western progress—the development of the primitive water wheel of 1870 into the high power turbines of the present day.

THE ELECTRIC FURNACE FOR PRODUCTION OF FERRO-MANGANESE — by E. S. Bardwell 120

A summary of demand and supply conditions affecting ferro-manganese, and an analysis of types of electric furnaces used in its production.

TERMINAL FACILITIES TO INCREASE FOREIGN TRADE — by Geo. F. Nicholson 126

The importance of electricity in the modern freight handling equipment of terminals and a description of some of the latest electrical devices used on piers

ELECTROMETALLURGY AND ELECTROCHEMISTRY IN THE WEST — by L. W. Chapman 130

An interesting and instructive review of the electrochemical and electrometallurgical industries which are becoming increasingly important in the industrial life of the West.

ELECTRIC WELDING IN RADIO APPARATUS — by F. A. Anderson 132

A description of delicate electric welding operations which have helped to bring to a high degree of perfection modern radio receiving and transmitting apparatus.

ELECTRICITY IN THE MACHINE SHOP — by H. L. Todd 135

A practical discussion of the selection and arrangement of electrical equipment for the machine shop, with special reference to adequate and scientific illumination.

The Great Industrial Empire West of the Rocky Mountains — Frontispiece 102
News 107
Electrifying Production in the Industrial West 112
Hydro-Slides for the Yangtsze River 118
New Western Turbine Installations—by Lewis F. Moody 119
Electricity in the Sugar Beet Industry 122
Industrial Development in British Columbia—by Hugh Dalton 124
Advances in the Electrical Manufacture of Paper 128
Electrification of Polish Industries 129
Increase in Manufactures in the West 133
New Ideas in Electrical Retailing—by H. B. Rogers 134
Problem Course in Electricity—by H. H. Bliss 136
The World's Fuel Supply 138
No Profiteering in Electric Manufactures—by H. L. Garbutt 139
The Thirty-fifth Year of Service to the West 140
Sparks 146
Personals 147
Builders of the West—XCIV—Lester A. Pelton 149
Happenings in the Industry 150
Business Conditions in Western Market Centers 154
Meeting Notices for Electrical Men 156
Latest in Everything Electrical 158
Books and Bulletins 159
New Electrical Developments 160
Salvage 162
A Partial List of Manufacturers Who Distribute Their Products in the West — with Their Distributing Outlets 163
A Partial List of Western Distributors with the Lines of Products Handled by Them 166

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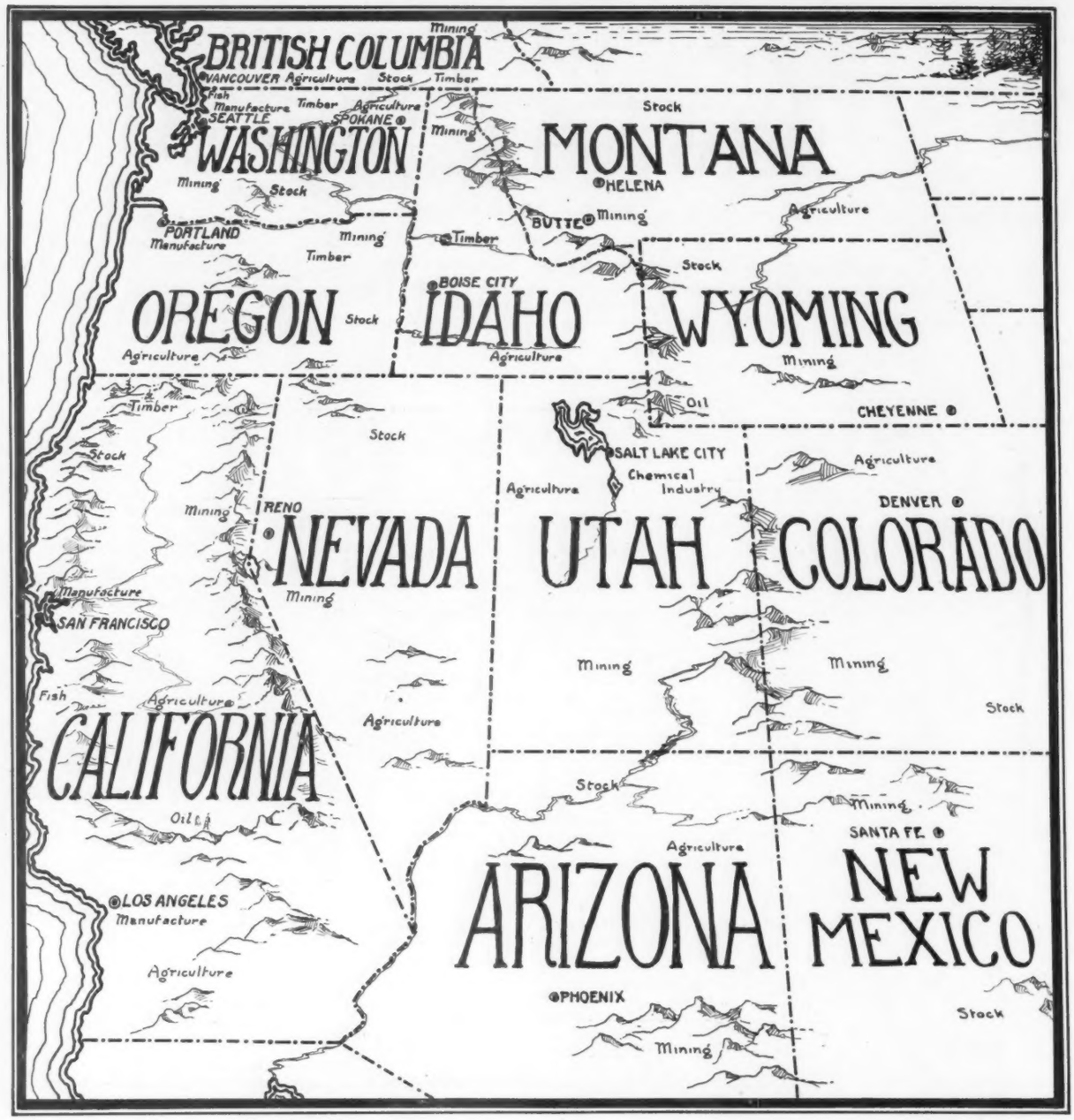

The Great Industrial Empire West of the Rocky Mountains

An idea of the scope and possibilities of the great industrial empire composed of British Columbia and the states west of the Rockies is to be gained from the following figures on important Western activities in 1919:

Area (sq. mi.)	1,567,651
Population (1920)	9,289,291
Bank Clearings (22 Western cities for 1920)	$20,576,000,000
Foreign Commerce, Pacific Coast ports	$1,206,600,000
Manufactures	$2,500,000,000
Farm Crops	$1,500,000,000
Live Stock	$1,763,640,000
Mining	$1,000,000,000
Lumber	$404,162,000
Petroleum	$150,000,000
Fish	$92,000,000
Installed Capacity, steam and hydroelectric plants	2,990,975 hp.
Potential Water Power	43,621,000 hp.
Construction program water power development, 1920 to 1929	$750,000,000
Expenditure for electric motors, 1920 to 1929	$117,500,000

Each great era of the world's history has centered around some point which has been the meeting place of the interests and trade of the West and the East. At the present time the west coast of North America, facing as it does the great market place of the Pacific, forms that point of contact.

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FEB -8 1921

Journal of Electricity and Western Industry

A publication devoted to the upbuilding of the great industrial West and the countries bordering on the Pacific

A McGraw-Hill Publication

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Interpreting Western progress through the application of electric power, light, and heat in industry and in the home

Vol. 46, No. 3 SAN FRANCISCO, FEBRUARY 1, 1921 Per Copy, 25 Cents

"Journal of Electricity and Western Industry"

It is becoming more and more apparent to every individual in the West that the industrial development of this vast section of our nation is inseparably bound up with the development of its basic industry —the generation, transmission and distribution of hydroelectric energy. This industry in the West has now assumed such gigantic proportions with such manifold relationships, that for clear thinking one must bear in mind not only the problems of the electrical industry as such, but equally important—the problems of the users of electricity.

This issue of Journal of Electricity ushers in an enlarged editorial policy for the paper and a change of name to that of "Journal of Electricity and Western Industry." The enlarged policy will reflect the point of view of the builder of the West not only for the electrical industry as such but also for all industry dependent upon this great servant in modern development. The new editorial vision will enable us to look at the map of the great West and the countries bordering the Pacific and visualize the fundamental economic possibilities of this region in terms of industrial expansion. This era is one of great developments, and huge experimentations are going on in all lines of industry that are making a very definite contribution to the upbuilding of the West. In these developments certain basic industries such as electricity and transportation play a fundamental part—and associated with them such essential factors in modern progress as mechanical appliances, conveying machinery, lighting, heating, generating equipment and a thousand other elements.

In the forwarding of this activity in its wider aspect the influence of Journal of Electricity and Western Industry must be felt.

It is with the advancement of the West as a whole that the Journal of Electricity and Western Industry is concerned and such cities as Butte, Salt Lake City, Denver, Vancouver, Los Angeles, San Francisco, Portland, Seattle and Spokane are of equal importance in its record of progress. To be specific, let us take one instance with which we are all familiar; namely, that of the San Joaquin Valley in California. The growth of this valley has been found circumscribed by its electrical development, the various phases of which have been frequently featured in these columns; but at the same time its metropolis, the city of Fresno, has grown into a community with intricate industrial relations to the district, which should be reflected in the enlarged vision of this paper. There is a certain mill supply house at Fresno, for instance, whose manager and department heads ought to know this paper. There are engineers at work in the general contracting line who should be in touch with its editorial thought. There are industrial managers of raisin plants who should become its stanch friends. There are operating men on ranches among our large users of electrical power in the pumping of water who should feel its influence. And above all there are the bankers and financiers who must look to this paper as the authority in their district on all matters pertaining to its material advance.

And so it must be in every section of the West. The executive heads of chambers of commerce and different commercial associations throughout this territory will be urged to catch the big vision. Industrial and agricultural holders of large blocks of power company stock will become the good friends of this publication. In a word, all those men in a community who are drawn together by their common consciousness of the driving vision of this empire in the making, will feel more and more the vital message of this, its spokesman.

Designed to carry clear thinking, in readable language, to the business and industrial interests throughout this section of our country, Journal of Electricity and Western Industry is to be the interpretation of the West in its industrial growth; it is to be the exponent of the spirit of the West—the leader in originating and fostering movements in the service of Western progress. Its work in the past has been toward this goal, and to this end in an even broader sense its services will now be dedicated.

New Industrial Electrical Inspection

There is much discussion abroad in the West relative to new industrial accident and safety legislation in the various commonwealths of the West at the present time. We commend most highly the broad viewpoint taken by the Industrial Accident Commission of California, in its hearings, and the fairness with which it is proceeding to go about the new legislation. It is true that the bill proposed in the present legislature of California has come late for discussion by citizens generally and particularly by men of the Electrical Industry. Nevertheless, we believe the legislation proposed as a whole is of such broad character, and represents such splendid cooperation between the Commission and industry generally, that the measure should pass.

Practically all the bad features of the previous bill of two years ago have been eliminated in the present bill.

The granting of temporary inspection permits by the master electrician is a great improvement, and makes possible the saving of long delays in the starting up of new equipment. The possibility of putting into force uniform inspection throughout California is a splendid new advance that deserves the support of all forward-looking citizens. The proposed enactment is not for the purpose of enlarging the powers of the Commission other than for electrical safety inspection.

The one point, however, with which industry should within the next three weeks concern itself is that of the question of fees to be charged for inspection work. There is no one thing in legislation that is liable to bring out more dissatisfaction than a misunderstanding on the question of fees to be charged for inspection. As a consequence, it is a firm conviction of Journal of Electricity and Western Industry that the California Industrial Accident Commission should immediately institute hearings to determine a fair relationship between cost of work installed and cost of electrical inspection. When this relationship has been determined in actual dollars and cents value, it should be inserted in the bill before it becomes a law and by this means, even though slight errors or overcharges may later develop, one great source of worry and complaint will have been eliminated, namely, the inharmony that is sure to arise when a commission must sit not only as a body for enforcement of law, but also for the determination of fees involved.

Electrification of the Coal Mines

Not only in the electrification of the oil fields have the power companies of the West done some real constructive conservation, but also in the electrification of the coal mines which operate in Montana and Utah. This electrification has in many cases meant the difference between profit and loss, and some of the small mines which had to shut down in a time when the country needed all of the coal it could get, have been able to resume operations. It has been somewhat of a task to convince the coal operators that they can run more cheaply and more efficiently with electric power when they have been able to furnish themselves with free fuel, but the added output of the mines using electric compressors, hoists and storage battery locomotives had settled the argument.

The increased efficiency of the electric drive, coupled with the idea of conservation of fuel, is ultimately going to bring about a completely electrified industry. When this day comes there is no doubt but that the West with its abundant resources in water power will become the seat of many new industries. It stands to reason that the eastern manufacturer will hesitate to expand his present plant in the face of rising fuel costs and the increase in freight rates. The plant will come to the place where there are raw materials and power, which means the West. It is admitted that the salvation of the United States lies in constructive conservation which is being preached on all sides, and the electrical industry in the West should make known the work which it is doing along this line, and study the possibilities of doing still more, so that this section of the country will be considered as the logical place for the establishment of new industries.

The Electrical Show Promoter

The electrical industry has been greatly benefited by the numerous electrical shows that have been successfully staged in the various cities throughout the West in the past few months. Too great care cannot be taken, however, by all of the different branches of the industry represented at these exhibitions, to inquire into the legitimacy of the promoters. There have been reported on several different occasions the presence of certain unscrupulous promoters in Western cities who by misrepresentation and other means have sought to feather their own nests at the expense of the electrical industry. Fortunately they have been discovered in time.

It is obvious that it is for the best interests of all concerned that no exhibitions of any character be put on at any time that are not a credit to the industry. Dealers and power companies of several eastern cities have had the uncomfortable experience of being forced to enter exhibitions against their will in order to save the standing of electrical developments. A rigid investigation should be given all promoters of this type of enterprise who pretend to have the backing of reputable concerns, and who seek to foist their schemes upon the unsuspecting public, and the most stringent measures should be taken to prevent such enterprises getting a start in the community. Business men should be fully informed of the danger of such unauthorized movements through the vigilance committee of chambers of commerce and similar organizations. It is much simpler to prevent such enterprises than to explain them away once they are started.

Quality

The editorial in the Journal of Electricity, which appeared in the December 15th issue, entitled "Public Scepticism Toward Cooperation" has created such widespread interest and discussion that it may prove helpful at this time to enlarge somewhat on a thought which was hinted at in this former editorial, but which might receive more attention.

The truth of the statement, "It pays to advertise," is generally recognized, but it is also recognized by the best advertising authorities that there is a qualifying clause; namely, "provided the quality of the product advertised is good". We believe it has paid and will pay to advertise the California Electrical Cooperative Campaign because the object of the campaign is better electrical service to the public, recognizing that the certain result of that service will be more profit to the individual and to the companies in the electrical industry. This is why the Journal of Electricity and Western Industry has heart and soul endorsed this good work in the past, and will continue to endorse it in the future. It pays to advertise the Cooperative Campaign because of the policy which the Advisory Committee adopted early in its work:

"Our policy is to develop our industry by educational methods, encouraging the practice of good ethical business methods and of improved service to the public. It is recognized that the practice of proper accounting, of other good business methods, and of good business ethics will result in companies and individuals being able to ask for their goods and service a price that will include a fair profit, and we hold that such exchange of goods, service and ideas for profit is legitimate and ethical, provided, that all parties in the exchange, including the customer, are benefited thereby.

"It is expected that the adoption of good business methods will also so increase the efficiency of the various branches of the electrical industry serving the public, that it will enable our industry to give the customer a better value for the dollar he spends for electrical service."

To the best of its ability, the Advisory Committee of the California Cooperative Campaign has applied these "yard sticks" to every proposed activity, and any failure to measure up to this standard of better service to the public has resulted in the rejection of the activity. It is well for the new campaigns that are starting up in the West to bear well in mind these activities of the California Campaign; and it is to be hoped that the Northwest Electrical Service League and the Intermountain Campaign will profit by the splendid work done in California—now a tradition in cooperative helpfulness in the West—and that quality service will always be characteristic of the activities of the electrical industry.

Public Ownership or Customer Ownership

So far the public utilities have gone through three stages in their development. First, the period when there was no regulation, when franchises were free and bonuses were given with stock. Second, when local regulation began, with the result that franchises were stricter, and the utilities were forced into local politics. Third, the condition of statewide regulation to accompany statewide service, and the assurance to the utility of a fair return, which meant at first a reduction of rates, but which largely has meant a slight upward trend on account of the increased cost of labor and material.

A fourth stage which has been suggested, that of municipal or state ownership, is being called for by certain of the public as a remedy for the present increases in rates by public utilities. A point which is not always understood by these, is that the public in effect already owns the utilities—owns them piecemeal in shares of stock—and what is more, regulates their rates through the utility commissions.

Under customer ownership the consumers, however, take a somewhat different position, demanding a fair return on the money they have invested, and realizing that their slightly increased rate for water, gas or electricity will provide this. There is the gravest doubt whether the highly efficient organizations which have been built up by public service corporations could be replaced by civil service men and women, and heads of departments, appointed or elected, who suffered the ever present danger of political interference, without greatly increasing the cost of operation.

This should be explained by men in all branches of the industry to the people with whom they come in contact. These should be urged to become stockholders in their local power company, as under the present conditions it is necessary for the West to develop her hydroelectric resources as quickly and efficiently as possible.

Engineering Advice on the Income Tax

The problem of figuring income tax returns for some of the large business houses is a matter of such technical intricacies, and involving such large sums of money, that it is of necessity given over into the hands of experts who prepare a report on the subject much as a lawyer prepares a brief. Usually these experts are specialists in accounting, or are lawyers who have focused their attention on this branch of law. There is a branch of this work which is distinctly the province of the engineer, however. Especially in cases where the element of depreciation enters in and a diminishing value of the property may affect the basis upon which the tax is figured, the questions involved are essentially those entering into valuation for other purposes than taxation. The possible savings or rebates upon past payments sometimes involve large sums of money, and are well worth the employment of an expert whose report, made upon an engineering basis, will have weight with the government department. There are, of course, economic problems which must be analyzed, just as there are such considerations in rate cases and other questions upon which an engineer must pass—and there are engineers whose special knowledge along these lines particularly fits them for this work. This is a new field which has not yet been entered by the engineering profession, but one in which the engineer will find a legitimate and growing opportunity.

Development of Power in National Parks

Only those who have scaled the lofty summits of the snow-capped mountains of the Far West, seen the massive barriers of rock crowned with wind-worn timber and watched the long rays of the early morning sun striking between the rocky pinnacles and casting deep shadows in the canyons below, can realize what exquisite beauty really is, and this is impossible of accomplishment by "motoring." Hence, it is with a certain sense of misgiving that we read the emotions of an Eastern editor in "motoring" through a Western national park, when he says "These parks must be kept forever inviolate, and handed down unspoiled as a wilderness playground for the whole people. They were set aside and dedicated to that specific purpose. Congress has no moral right to give away an inch of them for any other—not now or ever, not for or by a dam site". Unconsciously this editor has admitted that the building of roads into these great national scenic wonders has made possible his viewing a certain beauty of nature of which he would otherwise be deprived, even though by the construction of the modern highway the wilderness has thus ceased to be kept inviolate as such.

And so it is that there is much good that can be accomplished in the great playground of the West—our National Parks—that may throw open to the public the wonderful scenic beauties that otherwise would be accessible to only a limited few. Hence, it is in this broader sense that Journal of Electricity and Western Industry places itself on record as favoring everything possible that can be done to make our national parks as they now stand a precious gift of this generation to the generations to come. Let us not, however, while we are protecting them, keep from doing those things which in the modern advance of science and invention make possible the enjoyment of these beauties to untold numbers of citizens who otherwise could not enjoy them.

We hold the parks in trust for Americans of the future, and these may not rise up and call us blessed if we tamper with their heritage. Though the power needs of a future generation may be greater than ours, the advances of science may also add to their power sources. And once we have developed the waters of the national parks we have taken an irretrievable step. Though our successors should find a thousand new sources of power that would make our work superfluous, they cannot restore to the parks their old wild beauty.

Consequently Journal of Electricity and Western Industry wishes to go on record as favoring the taking from the Water Power Commission the granting of power development rights upon our National Parks as they now stand. We equally and emphatically, however, denounce any legislation that would bring additional National Parks or enlargement of present National Parks under any other jurisdiction than that of the Water Power Commission If this precaution be not taken we shall find ourselves bringing the national parks into political arenas far from the purpose of their founding. We believe too well in the integrity and broad vision of those who have control of water power permits under the national water power legislation of last spring to think that there will be any unwise granting of power rights. In fact, we are rather inclined to believe that political maneuvering would be more likely to bring through Congress legislation to violate our national parks than would this body—the Federal Water Power Commission—which is today functioning with such a high degree of efficiency.

Conservation of Forest Products

On another page of this issue is an article on the lumber industry, one of the major industries of the Northwest. It is not generally known that of the wood taken from a forest, only about one-third is utilized as lumber, the other two-thirds being waste, and to the West, which includes in its territory some of the greatest timber belts in the country, any move towards conservation of forest products must be of the greatest importance.

In this connection the work of the Forest Products Laboratory, a branch of the U. S. Forest Service, deserves honorable mention. During the ten years of its existence the laboratory has conducted extensive research directed towards the better utilization of forest products, and it has been estimated that the results, commercially applied, have been saving the country thirty million dollars annually. Among the fields in which very definite advances have been made are wood preservation, testing of strength of wood and wood products, pulp and paper, and derived chemical products. In designing crates for machinery, in ascertaining the worth of little known woods for pulp, in determining the mechanical properties of woods, and in investigating the efficiency of wood preservatives, the laboratory has made an industrial contribution which in itself would more than justify its existence.

The scope of the possible service of the laboratory is indicated also by the diversity of the industries to which its work has application. The primary and secondary wood-using industries produce goods to the value of over ten billion dollars annually, and employ more men than any other single industry in the United States. In addition to these there are the shipbuilding interests, the railroads, telegraph and telephone companies, building trades in general, and innumerable others that depend largely upon forest products for their materials. The Forest Products Laboratory is the only institution of research available to the lumber and woodworking industries for the solution of their technical problems, and these should see to it that the appropriation allowed by Congress is adequate to permit of this important work being carried on effectively. Appropriations hitherto have been uncertain and inadequate. Congress is now in session and plans to dispose of the appropriation bills before March 4th; any action that is to be taken, therefore, should be taken without delay.

LEGISLATION OF ELECTRICAL AND INDUSTRIAL INTEREST BEFORE STATE LEGISLATURES

The legislatures are now in session in most of the Western states and among the prolific showers of bills are several that are of electrical and industrial importance. Both California and Colorado have in contemplation a bill requiring the standardization and state inspection of all electrical installation, and the licensing of persons doing such work.

The creation of a hydroelectric commission is proposed in a bill before the Oregon legislature, to be appointed by the governor. They will make a survey of the present hydroelectric power plants of the state, and report thereon, showing the original cost thereof, the territory served by them, the cost per unit of horsepower, and any other information that the commission may deem necessary. Provision is also made for a general survey of the hydroelectric power which could be developed in the Columbia River gorge, and elsewhere throughout the state, with a view of development by the state.

The feature of the Montana session was the notice of a bill to establish a court of industrial relations, to supersede the present public service commission. It would have power to fix wages, hours and conditions in state industries.

The California legislature has introduced several measures which if adopted are bound to be far-reaching in their consequences. In order to meet the present embarrassing financial situation with which the custodians of the state's coffers find themselves confronted, it is proposed to raise the tax on public utilities approximately 34 per cent.

The following rates were recommended by the state comptroller and the state Board of Equalization:

	Present rate.	Increase 34.98 per cent.	New rate per cent.
Railroads and street railways	5.25	.0183	7.08
Gas and electric	5.6	.0195	7.55
Banks	1.16	.004	1.56
Insurance companies	2.	.0069	2.69
Franchises	1.2	.0041	1.62
Car companies	3.95	.0138	5.33
Express companies	.9	.0031	1.21

Another proposed bill would provide for indeterminate franchises for public utility corporations, holding that this would aid the financing of such corporations and make for better service.

Legislative inquiry into the State Railroad Commission is also proposed in the Senate. The proposal calls for an investigation by a joint legislative committee, and a public hearing during the legislative recess, and a report at the resumption of hostilities. It is reported that several other important bills are being held up pending the result of the investigation, among them one changing the method of choice of members of the Railroad Commission from appointment by the Governor to popular election.

Several other bills of engineering significance are also reported. The question of licensing engineers is again under discussion and various bills have been proposed for increased appropriations to the engineering departments of the state for the investigation of water resources and reservoir sites. Among these is a bill which has been framed by the water power committee of the San Francisco Commonwealth Club which would allow an increased appropriation to the State Water Commission for the purpose of more adequately fulfilling the duties of this body which has hitherto been cramped for lack of funds. This would provide for the policing of streams and the enforcement of water right rulings, an obligation which now falls upon the public itself. A definite sum for the investigation of reservoir sites and water resources would also be allowed the office of the State Engineer, thus placing the investigation of the so-called Marshall plan and other similar projects in the hands of authorized bodies already in existence and avoiding the dangers of special commissions which have a habit of becoming a perpetual drain upon state coffers. Outside advice could then easily be secured through advisory committees, along the cooperative lines so successfully carried out recently by the California Industrial Accident Commission acting with a joint committee of the electrical industry.

ELECTRIFIED FLOUR MILL AT OGDEN, UTAH

The formal opening of the Sperry Flour mill at Ogden, Utah, took place January 4th. This mill has been under construction for about two years, and its completion signalizes an important step in the industrial growth of Ogden and the inter-mountain country.

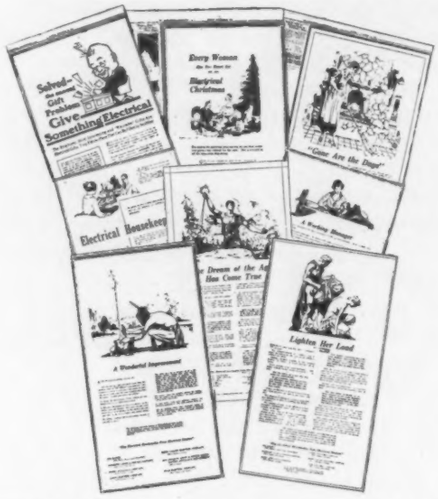
The latest word in electrical equipment is installed in the new Sperry Mill at Ogden

The mill will be electrically operated, with a maximum demand of about 480 horsepower, and has a capacity of 2,000 barrels of flour per day. The largest motor, one of 250 horsepower, operates the milling machinery, while smaller motors operate the apparatus for cleaning the grain.

One of the features of the mill's equipment is an electric oven in which experimental bread is baked daily, for testing purposes.

THE PROGRESS OF CO-OPERATION

Three years ago the idea of organized cooperation among branches of the electrical industry in the West was initiated in the form of a California Electrical Cooperative Campaign. At the opening of 1921 reports are received from four distinct cooperative organizations in the West, all of which show definite accomplishments and extensive plans for future activity.

The Northwest Electrical Service League which was formed at the September Convention of the Northwest Electric Light and Power Association has

Contractor-Dealers of Bakersfield, California, ran these eight half-page advertisements cooperatively in a Bakersfield paper for the nominal cost of fifty-six dollars apiece, with most satisfactory results as reflected in appliance sales.

made such rapid progress that men of the electrical industry in Washington and Oregon feel it will soon be the underlying basis of moral and financial support to the industry in this region. A representative advisory committee, with R. W. Clark of the Puget Sound Power & Light Company as its chairman, has done commendable organization work and has appointed a management committee to direct in an advisory way the activity of the League and a finance committee with F. N. Averill as chairman. The appointment of a manager-secretary and field man is being considered.

The British Columbia Electrical Cooperative Association is at the highest point of enthusiasm since the unqualified success of the Vancouver electric show which preceded the Christmas holidays and was effective in greatly increasing Vancouver sales, despite the general depression at this time. Needless to say, all British Columbia dealers are more than ready to cooperate in making extensive plans for the future.

The Rocky Mountain Electrical Cooperative League which was organized in Salt Lake City during November held a most successful meeting on January 14, at which time Emmet N. Britton, Managing Editor Journal of Electricity and Western Industry, gave a synopsis of the progress of the California Electrical Cooperative Campaign.

An advisory committee, composed of representatives of the manufacturer-jobber, the contractor-dealer and the central station, with J. A. Kahn, Capital Electric Company as chairman, is responsible for the splendid organization which has already been effected. An emblem has been chosen which will be used in the publicity campaign outlined to tell the story of the electrical industry to the citizens of this territory.

Plans are being made to extend the activities of the League to the states of Utah and Idaho, and also to that portion of Wyoming and Nevada served by Salt Lake City as a distributing center of electrical goods.

The organization of the California Electrical Cooperative Campaign has been perfected so that complete and detailed plans for the coming six months have been made. The schedule of subjects to be taken up each month as published in Journal of Electricity, January 1, has been pushed ahead one month as January has been entirely taken up with the making of plans. The subject of hydroelectric development will be treated along with all the regular monthly subjects.

An extensive publicity campaign is being planned to parallel the Convenience Outlet discussion which will take place in March and a paper by Garnett Young, "The Manufacturer's Viewpoint and Advances of the Convenience Outlet", which has been reprinted from the Journal of Electricity is being distributed to all national advertisers.

UTAH COURT RULES INTANGIBLE ELEMENTS NOT TAXABLE

Permanent injunction against the collection by the treasurer of Salt Lake county of taxes levied on an assessed valuation of $10,000,000, claimed to be the value of "intangible assets" of the Utah-Idaho Sugar Company has been granted by Judge J. Louis Brown of the Third District Court.

The decision was rendered in the case brought by the sugar company three years ago to restrain collection of approximately $198,000 in taxes in 1918. Since then two other years' taxes have accumulated, making the total amount involved at this time approximately $728,000.

The $10,000,000 was first placed upon the tax rolls by the County Assessor of Salt Lake county in 1918. It was his contention that the company had assets valued at $26,000,000 and was assessed for but $9,000,000. He placed the additional $10,000,000 on the rolls as representing a property value which was not otherwise assessed, and when asked what the property was declared it to be "intangible assets".

In rendering the decision the court expressed the opinion that the company has tangible properties which equal at least, and perhaps amount to more than the total value of all the outstandnig stock at its market value at the time of the assessment. The court further said: "Even if that were not so, in the absence of a statute which prevails in some

states, I think that the difference between the value of the tangible assets and the total value of the stock outstanding could not be reached as intangible assets, except that portion of it which is shown to be located here, and under the evidence I think there does not appear to be a margin in that respect. Some intangible property might have existed, for instance, the bills receivable which were payable at the home office of the company. The evidence showed that that was more than counterbalanced by debts owing, so the solvent credits would be offset by the indebtedness of the corporation."

The case may be taken by the county to the Supreme Court.

HOUSING SHORTAGE IN THE WEST

Although exact figures for the Western states relative to the national housing shortage will not be available until final figures are furnished by the census bureau, an informal survey of conditions indicates that the relation of housing facilities to population is at present fully ten per cent below normal.

The general consensus of reports received by the Journal of Electricity and Western Industry from a questionnaire sent to Chambers of Commerce and State Housing Commissions would seem to indicate that the condition in the West is fully as acute as elsewhere in the nation.

Aside from the social and civic effects of a shortage of housing, the industrial and building industry phases, including the effect of a stagnation of building on business conditions have been receiving considerable attention.

Not only will the lack of houses prove a serious handicap to the revival of business, but the city that has adequate housing will have a tremendous industrial and commercial advantage over its less equipped rivals.

It is estimated that there are 70,000 homes needed in Washington, and 35,000 in Oregon, while Idaho reports a probable demand of 5,000. This offers the prospect for an unprecedented and aggressive building activity throughout the West during the next few years.

UTILITY SECURITIES AUTHORIZED BY CALIFORNIA COMMISSION TOTAL ONE BILLION

The extent to which public utilities of the State of California have been forced during the past year to plan for the expenditure of many millions of dollars for construction and other work to meet the development of all parts of the state is clearly shown in a compilation made by the Department of Finance and Accounts of the California Railroad Commission issued January 17.

During the twelve months ending December 31, 1920, California utilities filed with the Commission applications to issue securities that aggregated $179,668,083.61. The Commission approved applications to the extent of $152,119,927.37, denied applications totaling $250,500, dismissed requests aggregating $3,491,560 and on December 31 had pending applications totaling $50,678,783.03. In only two years since the effective date of the Public Utilities Act, March 23, has the amount of securities authorized by the Commission in 1920 been exceeded. In 1914 the Commission authorized $226,725,501.98 and in 1916 $186,633,146.21. In 1919 the issues amounted to $72,774,902. Since March 23, 1912, the grand total of securities authorized by the Commission amounts to more than one billion dollars.

The following table shows a segregation of the securities and also a comparison with the previous year:

	Twelve months ended Dec. 31 1920	Twelve months ended Dec. 31 1919
Stock	$ 60,435,606.00	$16,151,816.90
Bonds	68,742,246.81	54,928,950.00
Notes	21,038,860.56	1,714,135.61
Certificates	1,903,214.00	
	$152,119,927.37	$72,774,902.51

EASTERN HEADQUARTERS OF JOURNAL OF ELECTRICITY AND WESTERN INDUSTRY

This airplane view of McGraw-Hill headquarters shows the McGraw-Hill Building, a ten-story structure located at Tenth Avenue and Thirty-sixth Street, New York City. The building houses some five hundred McGraw-Hill employes, as well as printing, engraving and photographic establishments, and constitutes the central office of the largest technical publishing house in the world—and one of the largest publishing houses of any kind. The eleven technical magazines published by the company have a combined circulation of 168,000, with readers in every quarter of the globe.

The New York office is a complete self-contained plant, equipped to handle all publishing processes from paper storage to mailing of magazines. It has an output capacity of about 25,000 completed magazines per day. All Eastern affairs of Journal of Electricity and Western Industry are handled at New York headquarters.

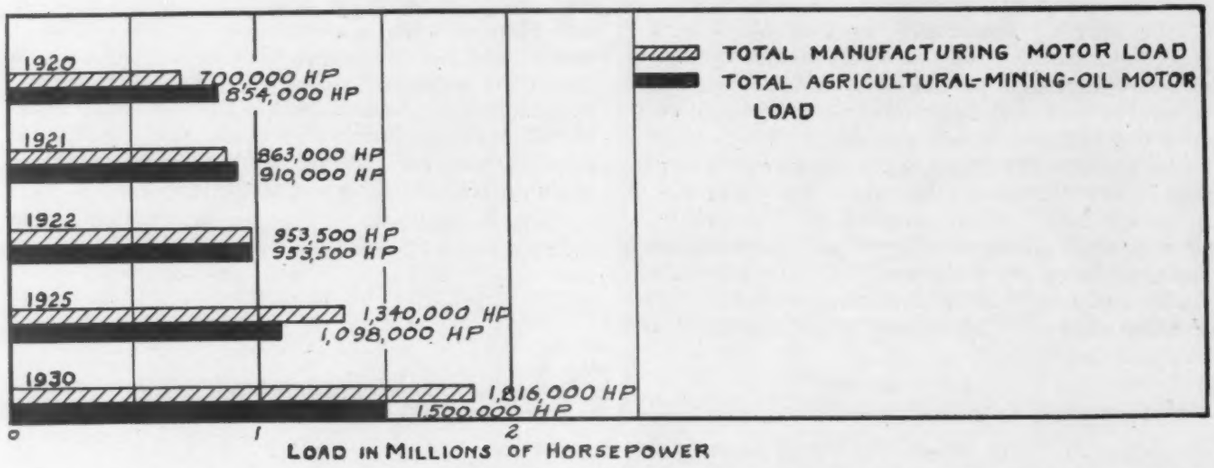


Chart showing the relation of manufacturing motor load to agricultural, mining, oil and allied motor load, as recorded by Western power companies. The present day relation and the future estimated relation are both given.

The Motor Market on the Pacific Coast

(The great power program which the West has planned for the next ten years is largely designed to meet the rapidly growing agricultural and industrial demand for electricity. The following article summarizes the extent of this demand as indicated by the motor market, and points out the future electrical business involved in industrial and agricultural development on the Pacific Coast.—The Editor.)

The motor market of the Pacific Coast is of the greatest interest to motor manufacturers, as it represents a concentrated, active market of considerable proportions. The approach of normal conditions marks the beginning of the greatest period of expansion that has been witnessed in the West, both on the part of the power producers and the power consumers.

A Ten Years' Power Program

With the expenditure of the $700,000,000 in the next ten years which the power companies of the West have already begun, a power increase of 115% of present capacity will be available. In actual figures, 2,511,000 hp. is to be added to the present total of 2,220,000 hp. Divided over the ten-year period, this means a capacity increase of 250,000 hp. yearly during that time.

Over 500,000 hp. of the added capacity is already in operation, or is under construction and will be in operation inside of the next two years. Important among the new plants, and time of their completion are: Kerckhoff, San Joaquin Light & Power Corporation, 54,000 hp., in operation now; Caribou, Great Western Power Company, 54,000 hp., in operation March, 1921; Big Creek, Southern California Edison Company, 52,000 hp., in operation March 1, 1921; Kern River, No. 3, Southern California Edison Company, 45,000 hp., June, 1921; Hat Creek 1 and 2, Pacific Gas & Electric Company, 32,000 hp., January, 1921; and Pit River, No. 1, Pacific Gas & Electric Company, 80,000 hp., January, 1922.

An actual survey of the conditions in the West, made through the commercial departments of the power companies and representative dealers, brings out some definite figures that are vital to motor manufacturers. Over the widely separated sections fed by the large power systems, fairly uniform percentages hold for the present connected motor load, its proportion of the total connected load, and the motor load which will be added as new power becomes available. Between 50 and 70 per cent of the present total load of the Western power companies is absorbed by motors, principally industrial and agricultural. Approximately 70 per cent of the additional power planned will be absorbed by the new motors to be installed during the ten-year period. Using the figures noted above, we see that 70% of 250,000 hp. or 175,000 hp. will be used in motors to be sold and installed each year for the next decade, in the Pacific and Rocky Mountain states, a most imposing figure.

Agricultural Motor Load

A survey made of the agricultural power load, in June, 1920, by Professor L. J. Fletcher, University of California Division of Agricultural Engineering, showed that the average horsepower installed in over 20,000 farm installations was 14 hp. These figures bear out the stock sheets of various motor manufacturers, which show the 7½, 10, 15 and 20-hp. motors to be the most popular and the most used sizes. This survey also brought out the fact that less than one-tenth of the available acreage was at the present time under irrigation, but that motors for pumping were being installed at a yearly rate of about 4,000, in California alone. Power companies report a definite, steady increase in the demand for power from farms, principally for irrigation and house service. It may be assumed, then, that in California alone,

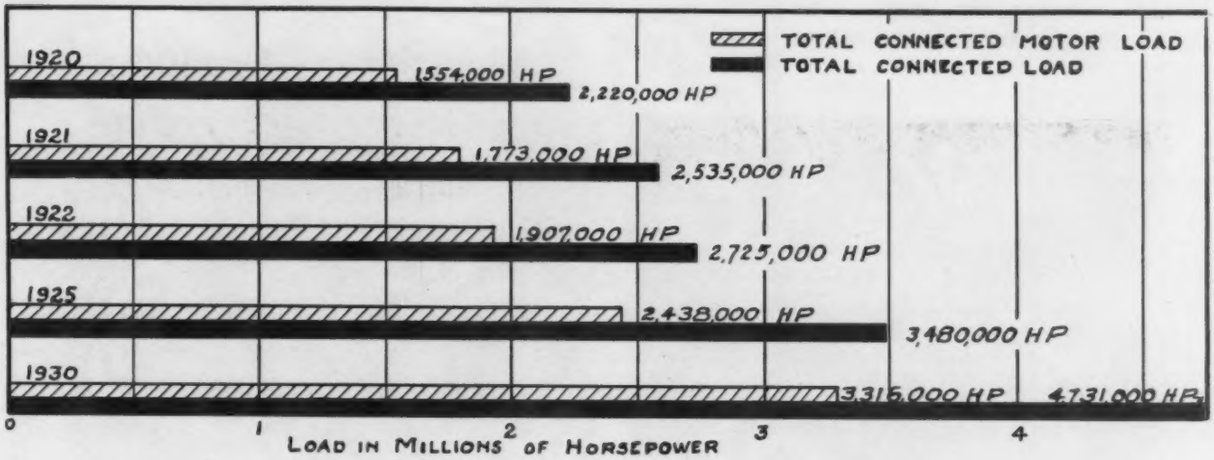


Chart showing the relation between the total connected motor load and the total connected load of Western power companies. The present relation as known and the future relation as estimated are both shown.

more than 90,000 motors will be installed during the next ten years. These figures can be more readily appreciated when it is remembered that the West increased over 30% in population in the last decade, while the nation as a whole showed only 14.6% increase. Three Western states top the list of population increases: Arizona with 63%, Montana with 46%, and California with 44%.

Industrial Demand for Electric Power

Startling as these figures are in regard to the present and future installation of motors for agricultural use, they are paralleled by the industrial use of motors. Estimates place the present number of industrial plants operating in the West at 10,000, with an increase during the past year of 1500. The increasingly available supply of electric power in the West, at rates from 20% to 40% lower than those prevailing elsewhere, and the serious shortage of coal and oil in the Eastern centers, is forcing an even faster increase in the number of plants being opened in the Western states. This statement is borne out by advices received from the power companies, in answer to a definite question put to them—"Is there apparent a definite, steady increase in the demand for current from industrial plants, both for machine operation and lighting?" The answer in every case was "Yes," and several companies added that the industrial demand was increasing faster than the agricultural demand.

Power Company Loads Classified

Definite figures from four of the largest Western power companies show the present situation in motor loads.

Power Company	Manufacturing Load	Agricultural, Oil & Mining Load	Industrial Load
Number 1	34%	35%	69%
Number 2	25%	18%	43%
Number 3	45%	34%	79%
Number 4	29%	56%	85%

A tabulation of some of the replies from a questionnaire sent to the major power companies on the Pacific Coast indicates that this state of affairs is quite general in all parts of the West, with good prospects for an important increase in motor load.

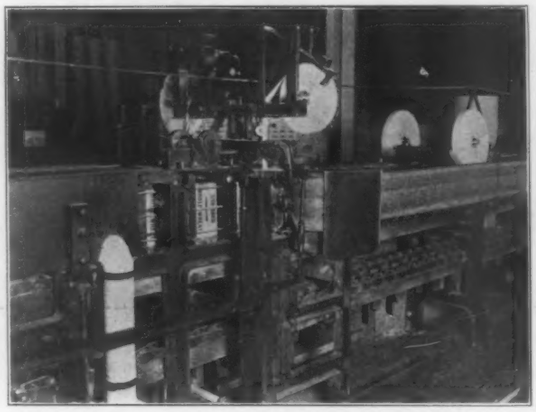
Location of company.	Total hp.	Motor load, hp.	Other industrial load.	Percent motor load to total load.	Per cent of new capacity for motor
Intermountain	260,000	200,000	50,000	77	....
Northwest	50,000	27,700	19,500	55	75
Northwest	140,000	112,000	20,000	80	75
California	450,000	400,000	30,000	89	70
California	33,500	16,000	17,500	48	....
California	36,000	28,000	6,500	78	70
California	165,000	143,000	15,000	87	70
California	933,000	565,000	160,000	60.5	75
Total.	2,067,500	1,491,700	318,500	72	....

Future Possibilities in Motor Market

The questionnaire sent to the dealers differed slightly from the questionnaire sent to the power companies, but the same future industrial and agricultural operations reported that the industrial demand was increasing steadily and about as fast as the agricultural demand. Dealers in purely agricultural sections naturally know nothing about the industrial end and only reported that a steady, heavy demand for farm motors was apparent. All unconditionally reported that prospects generally for electrical equipment and appliance business were excellent for the next few years.

In a recent article published in the Journal of Electricity, J. M. Morris estimates that for every kilowatt of generating capacity added by the power companies, an expenditure of $70 for motors is made by power consumers. Applying this to the annual power increase of 250,000 hp., or approximately 187,500 kw. now actually under way in states west of the Rocky Mountains, it is to be seen that the sum of $13,055,000 will be spent yearly for motors in this district.

Electrifying Production



FOOD PRODUCTS

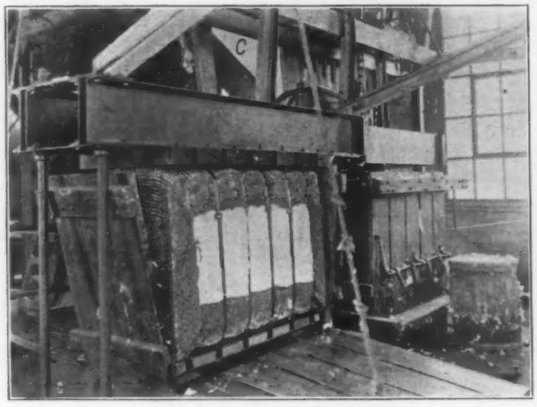
An electrically driven sealer in a modern Oakland, Cal., factory. Every operation in the manufacture and packing of a breakfast cereal is here performed by electricity.

SOFT DRINKS

An electrically driven bottling machine in a soft drink plant near Fresno, Cal. Carbonizing, bottling, and all the other processes depend upon electric drive.

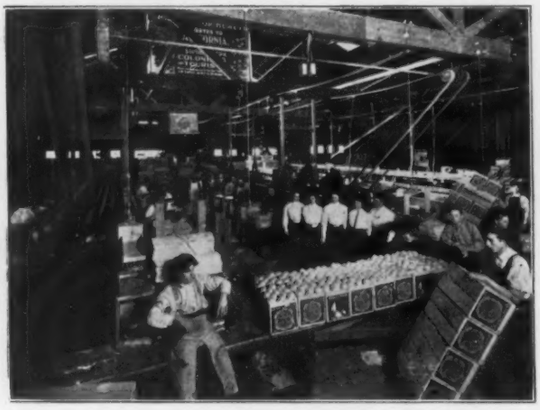
FISH CANNING

The largest fish cannery in the world is located at Bellingham, Wash. It has a complete electrical equipment, and an output of 50,000 cases a day, 1,000,000 cases a season. The cans are manufactured on the premises by electrically driven machinery.



TEXTILE INDUSTRIES

Bales of cotton in an electrically driven cotton gin in California. The cotton industry is an important one in Southern California, where the climate is favorable to its production.



FRUIT PACKING

In the great citrus belt of Southern California the majority of the packing houses are electrically driven, insuring perfect cleanliness in the handling of the fruit, as well as a large output.

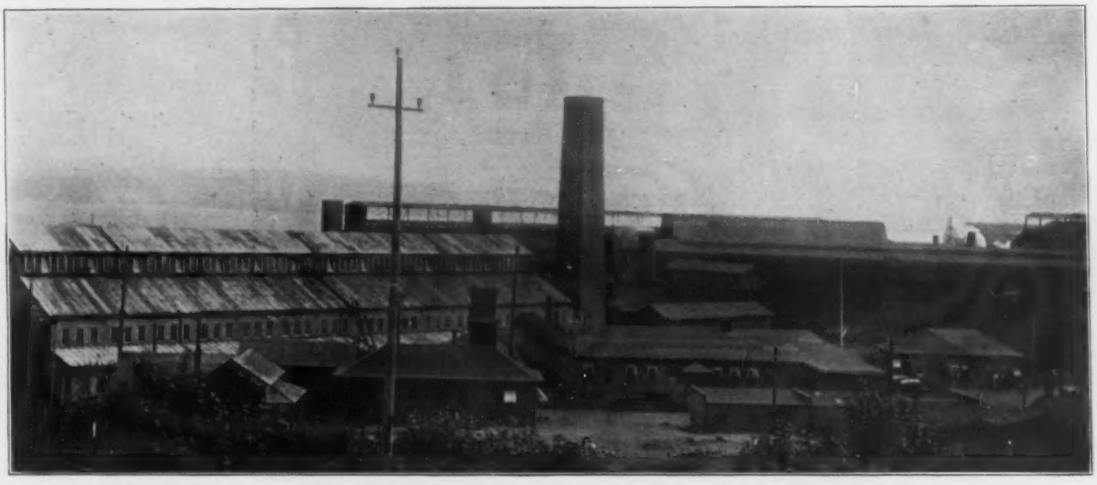
In The Industrial West

MAGNESITE

A magnesite mine near Spokane, Wash., electrically equipped throughout. This is the only magnesite deposit being worked in the United States at the present time.

COAL

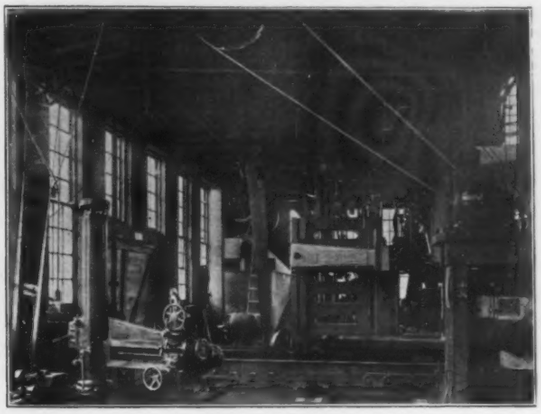
A coal mine near Seattle, Wash. All coal mines in this district use electric power exclusively for all operations, as well as for lighting and ventilating.



A large copper smelting and refining plant near Tacoma, Wash. Some of the largest copper mines in the United States are located west of the Rocky Mountains, and copper production and refining are important industries.

ELECTRIC FURNACE

Electric furnace in a steel foundry at Sacramento, Cal. The electric furnace is an important factor in Pacific Coast metal industries, and is widely used.



MACHINE SHOP

Electrically equipped machine shop in iron and steel works, Portland, Ore. Almost all large industrial plants in the West have their own machine shops, using only electric drive.

Electricity in the Lumber Industry

BY E. F. WHITNEY AND W. C. HESTON

(Greater efficiency and lower operating costs are making electricity the foremost factor in the lumber industry in the Northwest. Following is a review of the various applications of electric power which have been developed in connection with this industry. The authors are engineer with the General Electric Company, and industrial engineer for the Portland Railway Light & Power Company, respectively.—The Editor.)

The use of electric power in the lumber industry of the Pacific Northwest has advanced so rapidly, during the last decade, that it is now one of the prime factors in the operation of the modern saw mill, and is fast usurping the prerogative long held by steam in carrying the power load of logging camps and mills. It has touched with magic force the industry of the big woods, and is ushering in an era of scientific lumbering—a new epoch as distinct as that which began when the steam "donkey" and high-line cables superseded the ox-team logging of the early pioneers.

The Northwest is rapidly becoming the lumber producing center of the United States, and it is therefore only natural that the lumber industry should be the primary industry of this section. It has assumed such proportions that prosperity or depression in the industry is quickly reflected in all lines. It is estimated that the states of Oregon and Washington contain 720 billion feet of standing timber, or 42% of the timber on the Pacific Coast and 25% of the timber resources of the United States. Thus it is evident that the lumber industry and those industries which are closely allied with it, such as the manufacture of furniture and paper, cooperage, and a score of others, will play an important part in the development of the Northwest. Estimates for the year 1920 place the lumber production in Oregon and Washington at seven billion feet, with a value of $210,000,000.

Felling one of the giants in a northwest forest. Oregon and Washington contain one-fourth of the standing timber in the United States, with the result that the lumber industry ranks among this region's major industries.

Growing Popularity of Electric Drive

The first complete use of electric power for mill drive dates back no farther than a dozen years. Because of its departure from established practice, operators as well as saw mill designers continued for some years to look askance at this form of motive power. The rugged, reliable and efficient electric motor succeeded in overcoming the prejudice against electric drive after several years of steady performance, and today electric drive is the criterion, and the electrically operated mill is the accepted standard. Its flexibility makes possible more refined mill design and allows machines to be placed at the most advantageous point for efficient operation, assuring ample power to the driven unit independent of other operations in the mill, and at the same time eliminating all difficulties of power transmission to these machines.

Old mills formerly belt-driven throughout, with their maze of shafting, belting, pulleys, bearings, gears, etc., are converting to electric drive and effecting operating savings which had not been thought possible. The electric motor has helped more than any other one factor to increase production and promote continuous operation, and there is no reason for a new mill adopting any other method, when its predecessors have changed over to electric drive after years of operating experience.

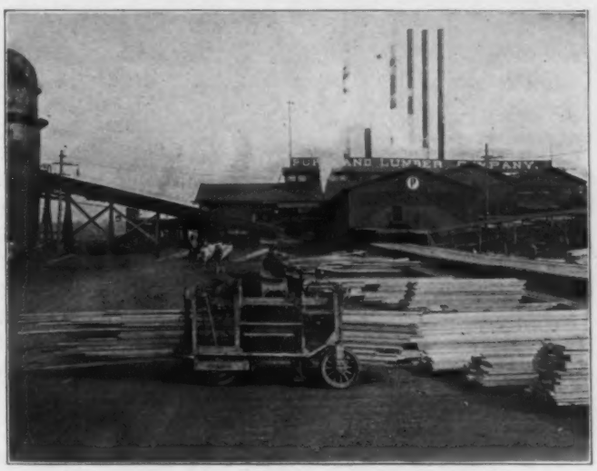
With the more general use of electric power have come more direct and refined applications of the motors to particular drives. The tendency toward elimination of all possible intermediate power-transmission or of speed-reducing schemes has been forwarded by the design of special motors and control equipment to make such direct applications possible. Today it is no longer necessary for a mill designer to favor the motive power in the drive scheme, but rather to lay out the simplest and most direct and rugged drive and then select the motor suitable for it. Motors are available for instantaneous reversible operation, for heavy or light starting duty, for continuous or intermittent constant or varying speed running, for multi speed (several fixed speeds) operation, and in fact, for all of the varied duties that one encounters. Care in the selection of the motive source and control equipment is all that is required. Successful performance depends upon the selection of proper control devices, but careful analysis of the best type of control equipment for any use is too often a secondary consideration.

Sources of Power

Because of their usual isolation from sources of power supply, sawmills as a rule install their own electric generating plants. The size of these plants is on the increase because of the tendency towards larger production, which in turn requires more power. Condensing turbo-generators are the usual

prime movers. Few mill builders appreciate the real economies that can be effected by careful power plant design and installation, including fuel storage, boiler plant and generating plant. This is but natural since the old scheme required engines to be near the loads they were to drive, and the boiler plant had to be as near to the engines as was possible, thus admitting of no latitude in design. Then later in the first electric installations the generating units were of small size, and the operating saving of a good installation over a poor one was of relatively small importance. But the tendency toward greater production, which increases the power requirements, makes it important to give careful consideration to the entire power plant, its location, the selection of equipment, and the plant layout, and in fact to all the factors which make for a reliable, safe, and efficient installation. Such an installation requires much thought and sound engineering judgment, but it fully repays all the preliminary worries in its regular successful and low cost performance. The day is fast approaching when all mill operators will appreciate that the installation whose initial cost is cheapest, is nearly always the most expensive in the long run. Present day conditions require the most careful analysis and the continuing of operating costs over the life of the operation.

Those mills so fortunately situated as to have electric power available from neighboring transmission lines of power companies, and all mills located in or near the larger cities, should give very careful consideration to the question of purchasing power rather than attempting to generate it themselves. Local conditions will largely influence the ultimate decision, but as a general rule a comparison of the savings of purchased power with those made possible by power generation at the plant will be distinctly in favor of the former, not only in connection with mills but also for logging operations.

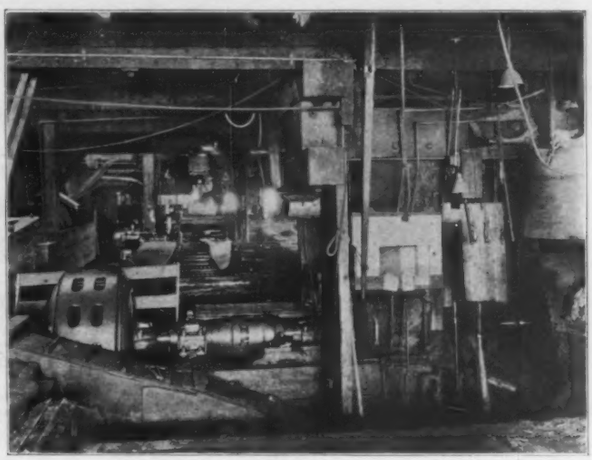


Electric lumber carrier operated by storage batteries used by the Portland Lumber Company, for transporting lumber about the yard. Electric traction is capable of a number of applications in the lumber industry, not only in connection with mills but also for logging operations.

Electricity for Logging Operations

In recent years a great deal of interest has been shown in the extension of electric power uses to logging operations. A large number of test installations have been made, all of which in their field of inquiry have been successful, and have more than justified the expectations as to performance and economy. A source of electric power is however necessary, and as logging operations are as a rule remotely located, many operations are immediately removed from the field of present day electric logging possibilities. There still remain many which are not so remote, however, and this is one of the most profitable applications open to the consideration of fortunately located loggers. There have been in regular commercial operation for several years electric yarding machines and electric loaders. Electric unloaders, electric pumps for water and fuel supply and camp lighting and domestic uses are old in their applications. In all cases the electric installations in the woods have shown more than satisfactory savings. This field of investigation deserves a thorough analysis and very careful consideration by progressive loggers before they classify themselves as one of those unfortunately situated.

Electric yarder and duplex log loading outfit installed at the Snoqualmie Falls Lumber Company. Electric power for logging operations is rapidly gaining in favor, proving both economical and efficient.



A 500-hp. motor direct connected to two 60-in. head saws. This is said to be the fastest "head rig" in the Northwest. This mill saws 250,000 ft. B.M. per day and holds the world's record for the largest continuous annual output for a single heading mill.

Electric Locomotives

Industrial electric locomotives are largely used around lumber yards for transporting the manufactured product, yard switching and car spotting, and electric trucks of various types have been very generally adopted. There has been little standardization along these lines.

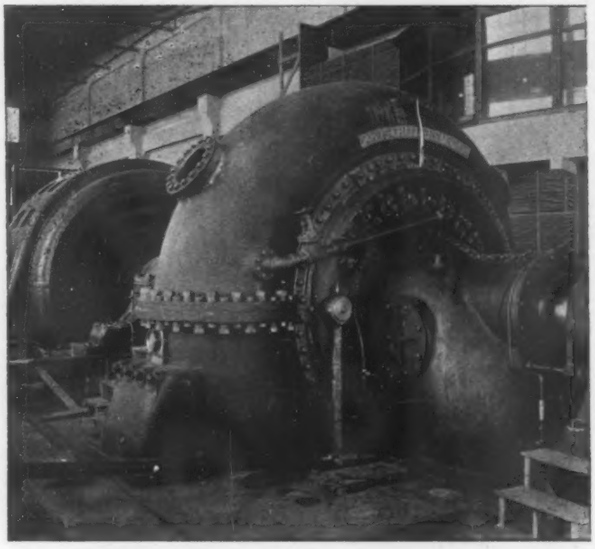
Another field, that of electric logging railroad operation, has received very little of the consideration it deserves. Logging railroads are seldom of great length but in nearly all cases they abound in heavy grades and many sharp curves. The grades are as a rule in favor of the load. Because of the relatively short main line length and the large number of spurs to the logging scenes, switching makes up a great part of the logging locomotive's duty. Switching and heavy grade main line haulage happen to be the strong point in the most representative electric railway installations made by our main trunk line railways. It is therefore reasonable to assume that logging railway operators have a fruitful field in which to make operating economies. It only requires their initiative to institute a skilled and careful investigation in order to ascertain the possibilities of electric operation of their logging railways.

Tendencies in Development of Hydraulic Prime Movers

BY S. L. SHUFFLETON

(Hydraulic prime movers capable of handling increasingly higher heads and involving increasingly large concentration of power in single units, are matters of great current interest to industry throughout the West where water-power development at present is taking place on such an unprecedented scale. The author of this article, the Pacific Coast manager of Stone and Webster Company, who has charge of the construction of the Caribou Plant of the Great Western Power Company, is unquestionably the soundest authority that can today be found on this important question.—The Editor.)

When an ingenious individual in the early mining camps of California attached some buckets to the rim of an old wagon wheel and projected water from a nozzle against the buckets he unknowingly became responsible for the present development of electric energy by water power. These primitive "hurdy-gurdies," which developed from two to twenty horsepower, and had an efficiency of about twenty-five per cent, are the direct forerunners of the modern impulse turbine. The most recent and by far the largest of these are the units now being erected in the Caribou plant of the Great Western Power Company, which have steel buckets thirty-six inches wide, receiving an impact of 84,000 lbs. from a thirteen-inch nozzle, and having an efficiency of eighty-seven per cent.



One of the most powerful high head turbines in the world, a 23,800-hp. Allis-Chalmers installation at the White River plant of the Puget Sound Power & Light Company, which furnishes part of the power to the Chicago, Milwaukee & St. Paul Railroad electrification.

Coincident with the discovery of the tangential wheel, the first reaction turbine was invented in 1849 by J. B. Francis, the eminent hydraulic engineer. This was a turbine proper, as distinguished from the impulse turbine. The Francis type is used universally in America today.

The impulse type wheel as originally developed by L. A. Pelton, about 1870, is the only impulse turbine to secure continued use under American conditions. The Pelton type wheel is classed technically as a tangential turbine, but is commonly referred to as a wheel in America, turbine being applied to a reaction turbine of the Francis type.

Turbines may be further classified, according to the direction of flow as radial outward, radial inward, axial or parallel, or tangential; or according to the position of the shaft as vertical or horizontal.

Structure of Impulse Turbine

In the impulse turbine the shaft carries a runner or disk bearing on its periphery a series of cups or buckets which receive a stream of water from a nozzle, coming at a spouting velocity due to its head. The runner is enclosed in a semi-circular casing and the speed of the wheel is regulated by a hand-operated or automatically controlled needle with a conical head inside the nozzle. An automatic sleeve type deflector directly connected to the governor is sometimes provided for emergencies.

The impulse type turbine is capable of being adapted to various types of installations, ranging from the Nooksack Falls plant of the Puget Sound Power and Light Company, where one water wheel unit of 3,000 hp. is made up of six runners, each driven by two nozzles under a 175-ft. head, to the Big Creek No. 1 power house of the Southern California Edison Company, where a single runner develops 10,000 hp. under a 2000-ft. head. This type has been extensively used for high heads but successful ones have been developed for low heads, notably at

the Salt River irrigation project, where a development of 1000 hp. under a 110-ft. head showed an efficiency of eighty-three per cent.

Structure of Reaction Turbine

Structurally a reaction turbine consists of a ring or pair of rings, to which are attached curved vanes arranged uniformly around the circumference, revolving on a shaft or spindle to which the ring or pair of rings is connected by a boss or arms or other suitable means. The part just described is enclosed with a casing which is usually provided with guide vanes, between which the water enters the wheels, and which guide it in the right direction.

Early Commercial Development of Turbines

The first large sized commercial turbines were developed at Niagara Falls. It was believed at that time that it was impractical to use heads as high as 175 ft. The original installation of the Niagara Falls Power Company was composed of turbines operating under a head of 130 ft., although 165 ft. was available. These turbines, which were noted throughout the world as enormous units, developed approximately 7000 hp. There are turbines in operation at Niagara Falls today developing 50,000 hp.

One of the first high head turbine installations was built by the Platt Iron Works for the Snoqualmie Falls project where 9,000 hp. was developed under a 270-ft. head at 300 r.p.m. Another pioneer installation was built by Allis-Chalmers for the Centerville power plant of the Pacific Gas and Electric Company, where 10,000 hp. is developed under a 572-ft. head. A notable low head installation is in operation at the Keokuk project in Iowa, where there are fifteen units, each developing 10,000 hp. under a 32-ft. head.

At the present time a number of turbine manufacturers will undertake to build reaction turbines for heads up to 850 ft. There are four outstanding features in the modern development of prime movers, or hydraulic turbines. The first is the increase in the size of the units, both impulse and reaction. The second item of importance is the development of automatic and remote controlled plants of comparatively small capacity as feeders into the parent system. It is also being demanded that all hydraulic prime movers shall return in active work the greatest possible proportion of potential energy in the water and, finally, that greater precision and reliability of speed control be developed in the governing apparatus.

Demand for Larger Units

This demand for larger hydraulic units is a direct result of the increased size of the electric power distribution systems. The amount of power now collected into a single system with the consequent problem of its transmission is without precedent. Under these conditions, a hydraulic unit of large capacity is relatively small in proportion to the total output of the system and single generating units of enormous size are now required to successfully charge the lines.

As most of the small, easily developed, hydraulic power installations have long since been made, the continued demand requires the development of great reservoirs to conserve, and equalize throughout the year, the annual runoff of watersheds having hundreds of square miles of drainage area. The use of such stored water, and the development of rivers as a single project involving the installation of numerous hydroelectric plants, with definite plans for the efficient utilization of the natural topographical conditions, is now common practice.

Casting for one of the new 22,500-hp., 600-r.p.m. Pelton reaction turbines for the Kern River No. 3 plant of the Southern California Edison Company—a world record in high head installations.

The size of the hydraulic units is directly in proportion to the size of such systems, 15,000 hp. from a single impulse turbine with heads up to 2,000 ft. is an accepted fact. Obviously, two such runners on a single shaft means 30,000 hp. per unit. Designs are now being considered for impulse units of 40,000 and 50,000 hp. and reaction units up to 70,000 hp. and nothing stands in the way of their successful installation.

Modern conditions require that each plant generally have independent water wheel and motor driven, direct current exciter sets in duplicate, each set having capacity to excite fields of all main generators in the plant.

Increased Use of Reaction Types

The demand for units of greater power has, naturally, had the effect, where heads have been moderately high, of changing the type of design from the impulse to the reaction turbine. For example: a maximum output of 5,000 hp. under a head of 700 ft. would fall naturally within the field of the impulse turbine; a development requiring units three to four times this capacity under the same head, however, would probably be made with reaction turbines. This condition must inevitably lead to the building of reaction turbines for increasingly higher heads.

The highest known head under which reaction turbines have been built at present is at the Kern River No. 3 development of the Southern California Edison Company, where there are being installed

two 22,500-hp., 600-r.p.m. Pelton reaction turbines, under an effective head of 800 ft.

Much attention is being given to the construction of automatic generating plants of comparatively small size, where there is available a small amount of water and where the amount of power developed

The Folsom plant,' an early California hydroelectric installation, was equipped in 1896 by the S. Morgan Smith Company with four pairs of turbines operating under a head of 55 ft., each direct connected to a 1000-kw. generator.

would not pay for the cost involved, were it necessary to maintain personal attendance.

Recent Improvements in Hydraulic Equipment

Automatic plants are now developed to a point where, by means of a simple switch in the control station, it is possible to start up the hydraulic equipment, bring the unit to speed, synchronize and take on load up to full capacity—every step being carried out consecutively and automatically.

Remote controlled plants are also being built in considerable number; such installations usually involving the use of an induction generator and while not automatic in the full sense of the word, are controllable from distances of several miles.

Efficiency of modern hydraulic equipment has been much improved in the past few years. Impulse turbines are operating with efficiencies in the neighborhood of eighty-six per cent, while reaction turbines have an efficiency of ninety-three per cent. Improvements are constantly being made in both types of prime movers and it is not unreasonable to expect even better results than at present.

The efficiency of an impulse turbine, while being somewhat lower, is sustained more uniformly over a wide range of load than in the reaction turbine. This, together with the natural simplicity of the impulse turbine, favors its selection in many instances otherwise suited to the reaction type of unit. On the other hand, the reaction turbine has inherently the advantage of making possible a higher speed of rotation under the same conditions. In units of large capacity, this frequently means a big saving in cost of equipment and installation.

In the modern, high-power installations, the requirement for precision and absolute reliability of the governing equipment is paramount. When it is considered that the entire stroke from no load to full output of a 40,000-hp. reaction or impulse turbine will probably not exceed 8 in., the equivalent of a 1 in. movement of the governing elimination of lost motion and the precision of movement in the governing mechanism is essential.

Reliability in service is obtained in greater degree than heretofore by installing duplicate independent governing systems, each system having its own oil pressure set consisting of water wheel and electric motor-driven pump, and duplicate pressure accumulating tanks.

Each oil pressure set is made of capacity sufficient to provide regular and emergency governing for all units. Each set is then cross-connected to its neighbor on either side, thus providing means for one oil pressure set to supply governor oil to all main turbine units, while another oil set is held in reserve. In a power house consisting of several units, this arrangement gives an elasticity to the entire installation and has been found very satisfactory.

Wheels for Individual Requirements

In the past fifteen years the trade in standard stock wheels has given way to the wheel especially designed and built for meeting individual requirements. The efficiencies and operating records of the modern American-made turbines are excelled by none. The developments in the hydraulic turbine field in this short space of time as to magnitude, effectiveness, simplicity and safety in operation, and above all, as to the time required for accomplishing the work seems almost incredible.

The West, which has been since the beginning the pioneer in the successful development of hydroelectric energy by the use of hydraulic prime movers, will undoubtedly continue in this role, since no other section of the country possesses the enthusiasm, vision or daring so necessary in this peculiar field of the pioneer, nor indeed, does there exist in any other section of the world today such tremendous opportunity for development on all sides as is to be found in the district West of the Rockies.

"HYDRO-SLIDES" FOR THE YANGTSZE RIVER

Shallow draft boats, driven by airplane propellers and drawing but eight inches of water, are to be used on the Yangtsze River in Szechuen Province and their advent will make possible a fifteen-hour journey from Ichang to Chungking and from Chungking to Chengtu. At present the trip is made in from four to twenty-five days.

The unique craft, which for years has proved its utility in the everglades of Florida and on the upper Missouri River, and was an acknowledged success in Mesopotamia during the war, is the latest attempt to solve the transportation difficulties of the rough and shallow upper Yangtsze.

The type to be used in China is known as the Lambert "hydroglisseur" or hydroslide, a model similar to that used by British troops in Mesopotamia for carrying mails.

Before a regular service is assured, the hydroslide will be given a series of trials for which no expense will be spared. It is believed that they will be successful because of the peculiar adaptability of the air-driven boat to conditions as found in the upper Yangtsze.

New Western Turbine Installations

BY LEWIS F. MOODY

(Significant of the large-scale hydroelectric developments in progress in the West are the new turbine installations now under construction for Western companies. Two of these are here described in detail by the consulting engineer for the I. P. Morris Department of the William Cramp & Sons Ship and Engine Building Company.—The Editor.)

Two turbine installations of particular interest are now under construction by the I. P. Morris Department of The William Cramp & Sons Ship & Engine Building Co. of Philadelphia. These are the 30,000-hp. turbine for Big Creek No. 8 Power Plant of the Southern California Edison Company, and the 14,250-hp. turbine for the new Upper Falls Development of the Washington Water Power Co. at Spokane. Both of these turbines are of the reaction type, the Big Creek unit exemplifying the most recent practice in the design of high head turbines, and the Washington Water Power Company's unit representing the most approved practice for low and moderate heads.

Big Creek Development

The 30,000 hp. turbine for the Southern California Edison Company will operate under a head of 680 ft. at a speed of 428 revolutions per minute, and the specific speed is accordingly a normal value of 21.

The design of the turbine is of particular interest on account of a number of innovations which have been incorporated.

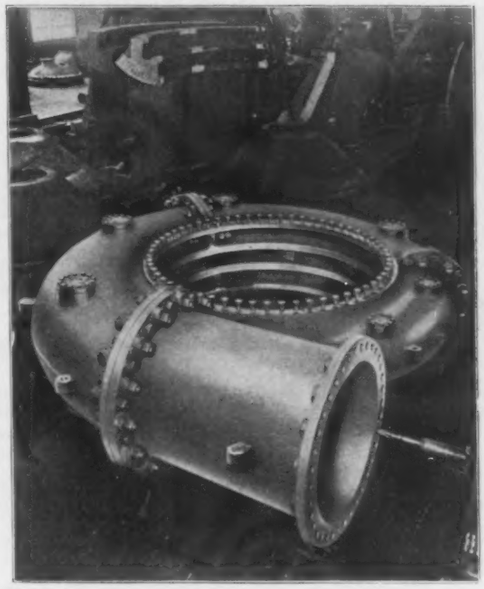
The turbine casing is of cast steel built in three sections. The stay vanes are cast integrally with the casing sections, no separate speed ring being used. This practice greatly simplifies the design and can be used when the material is cast steel since all initial stresses can be relieved by annealing. The water enters the casing through a 72-inch Johnson valve, and a tapered section of penstock between the valve and turbine, this section reducing in diameter from 4 ft. 8 in. at the discharge end of the valve to 4 ft. 2 in. at the casing intake. The pressure above the runner is relieved through two relief pipes discharging into tailwater.

Draft Tube and Guide Vanes

The draft tube is of the Moody Spreading Type, similar in form to the tubes used in the 37,500 hp. turbines for the Niagara Falls Power Co. and the 55,000 hp. turbines for the Niagara Development of the Hydro-Electric Power Commission of Ontario. This form of tube conducts the water away from the runner by symmetrically diverting it into the radial direction with respect to the turbine axis without producing any sudden changes in either the axial or the whirl components of the velocity of discharge from the runner. There is no elbow in which eddies can form, as in draft tubes of the usual curved type, and the formation and breaking down of vortices is thus avoided.

The turbine is equipped with the new Overn disk type of guide vanes, the vanes being cast integrally with two disks which have their faces flush with the surfaces of the distributor plates. The vane is offset from the axis of the stem and is strongly supported by the two disks. When closed, the connection between the disks and the vane prevents the leakage which ordinarily takes place above and below the vane, this leakage being a frequent source of corrosion of the distributor plates and runner vanes.

The runner is equipped with labyrinth seals, which are calculated to reduce the leakage to between one-half and one-third the usual value. The use of these seals will be of particular advantage after the unit has been in service for a considerable time, since they will prevent the rapid increase in wear which sometimes occurs in high head reaction turbines, and will make it possible to provide and maintain effective pressure relief above the runner.



View of casing for the Big Creek 30,000 hp. turbine, taken during construction in the shop. This is of cast steel built in three sections, the stay vanes being cast integrally with the casing sections.

New Design of Governor

The valves controlling the supply of fluid to the governor and hand control are operated from a single lever by means of fluid operated plungers. The usual governor arrangement requires the separate operation of at least five and usually six valves, which must ordinarily be operated by hand. In this governor, the throwing of a lever admits fluid pressure to all of the valves which must be shifted, and the entire operation of shifting from governor to hand control, or back again, is automatically completed. The governor is also arranged so that the hand control will maintain a position to enable the change-over to be made without changing the position of the turbine gates.

The unit is provided with the Taylor lubricating system, operated by air pressure through a central grease gun, by means of which the bearings of the operating mechanism may be individually supplied with grease under pressure. The governor pressure for the unit will be supplied by two pumps, the governor pressure being 200 lbs. per sq. in.

A relief valve is provided, connected to the penstock section just in advance of the casing intake. This valve is operated by direct mechanical connection to the gate operating ring through a dashpot mechanism which can be arranged to give either synchronous or slow closing operation for water saving. The arrangement is such that if the relief valve should fail to operate from any cause, the wheel gates will be blocked until the relief valve moves, thus preventing any possibility of causing dangerous pressures.

Spokane Falls Development

The 14,250-hp. turbine for the Spokane Upper Falls development of the Washington Water Power Company will operate under a head of 64 ft. at a speed of 105.8 revolutions per minute, and will therefore have a specific speed of 70.

The turbine will be set in a concrete volute casing. The casing is of interest because instead of employing the usual straight-sided outline it is of cross-section, or similar in form to metal casings used under higher heads. This form of section is suitable for connection to a circular penstock and permits the casing to be strongly reinforced, a matter of some importance in this plant on account of the considerable length of penstock. The casing is 17 ft. in diameter at intake.

The turbine, like the Southern California Edison unit, is equipped with the Spreading draft tube. The type of draft tube will have a much greater effect upon the maximum efficiency of the turbine in connection with this unit than in the case of the high head unit, on account of the much greater proportionate amount of velocity head at the runner discharge. The use of this draft tube should permit very high efficiency to be obtained from the turbine.

This unit is equipped with the same type of governor as that described above, and also includes the control system previously mentioned. The operating mechanism controlling the guide vanes is of the Rogers type, involving the use of links which act as struts or compression members in closing the vanes. They are fitted with renewable collars which will shear when two vanes close upon an obstruction under full governor power.

The turbine will be equipped with the pneumatic lubricating system similar to that described for the other unit.

The Electric Furnace for Production of Ferro-Manganese

BY E. S. BARDWELL

(Both in quality of output and efficiency of operation the electric furnace has proved itself a most important, and sometimes an indispensable, factor in the production of metals. The following article takes up advances in electric furnaces for the production of ferro-manganese. The author is metallurgist with the Anaconda Copper Mining Company at the Great Falls reduction department.—The Editor.)

Manganese is a metal very similar to iron in many of its properties but having a much greater affinity for oxygen than has iron. Its alloys with iron are known as ferro-manganese. The alloy in most general use contains 80% manganese, 12.5% iron, 6% carbon and 1.5% silicon. Alloys which contain less manganese than iron are, in the trade, classed as spiegeleisen. The industrial importance of ferro-manganese began in 1866 with the introduction of the Bessemer process. This process requires a strong de-oxidizing agent to make sound steel. With the passing of the Bessemer process has come an increasing realization of the necessity of sound steel, and the use of ferro-manganese has been extended until in steel manufacture more ferro-manganese is used than any other ferro alloy. It finds an important use in the manufacture of manganese steel, giving to the metal a greatly increased hardness without rendering it brittle.

The ores of manganese which furnish the chief source of supply are oxides and carbonates containing from 35 to 40% manganese in the case of the latter, and from 40 to 55% in the case of the former with varying amounts of iron, silica, alumina, lime and magnesia. Given an ore of this character the problem of reduction is relatively simple. The ore is mixed with sufficient limerock to flux the silica and alumina which it contains, and sufficient coke or other carbonaceous material to reduce the iron and manganese, and raised to a temperature sufficiently high to bring about the reduction. If the ore does not contain sufficient iron, iron is added either in the form of ore or turnings. If this operation is carried out in the iron blast-furnace additional coke must be used to attain the required temperature; in the electric furnace electrical energy supplies the required heat.

Early Production of Electric Ferro-Manganese

Until about four years ago ferro-manganese was produced exclusively by smelting in the iron blast furnace. In the iron blast furnace ores high in silica cannot be used because of the excessively high slag losses. The limit is usually placed at 12% silica. Owing to the high temperature required to reduce manganese, the coke consumption is high; nearly three tons of coke per long ton of metal, and the wear on the furnace lining is excessive. The recovery of manganese is probably seldom in excess of 70%.

The unusual economic conditions brought about by the World War, the shortage of high grade manganese ores and the increased demand for iron and

steel, caused attention to be turned to the electric furnace, and during the latter years of the war very considerable amounts of the alloy were produced in this manner.

Stassano produced ferro-manganese in an experimental electric furnace as far back as 1908. The electric furnace when properly designed and operated possesses the advantage of being able to treat lower grade ores than it is economical to treat in the iron blast furnace, and with higher recoveries of the manganese content.

The electric furnace employed by Stassano was of the familiar type employed by him in the making of steel. The charge was smelted by the heat radiated from an open arc. The furnace that has been most successfully employed in this country consists of an open-top crucible, usually not over three feet in depth, with submerged arc. Such furnaces are usually operated on three-phase alternating current with three carbon electrodes, one on each phase. The early attempts to produce ferro-manganese in the electric furnace failed largely on account of the excessive volatilization losses due to the high temperatures obtained. In the modern furnace, by proper design, the temperature is controlled and volatilization reduced to almost nil.

In a short article it is impossible fully to cover the design and operation of electric ferro-manganese furnaces. I shall, therefore, confine myself to a few notes on the more recent practice.

Size and Shape of Furnaces

First, with reference to the size of units, experience seems to show that the most economical furnace to operate, from a metallurgical point of view, is one of about 1600 to 1800-kw. input. Such a furnace can be operated at from 65 to 70 volts. A recently constructed furnace operated at 68 volts with about 1800 kw. input is producing about 13 long tons daily of 80% ferro-manganese, when treating ore containing from 53 to 55% manganese, and is making 90% recovery of manganese. With higher voltages it is possible to get more power into the furnace, but at the sacrifice of metallurgical efficiency.

The furnace crucible is usually a rectangular steel shell with lining consisting of carbon blocks tamped in with a suitable mixture of carbon and pitch. It is important that the furnace crucible be set up off the ground so as to permit of circulation of air underneath the furnace. This not only prolongs the life of the furnace lining, but aids in keeping down the temperature which might otherwise be excessive. There is a tendency at present to make the shell and crucible oval in shape. An oval-shaped furnace is slightly cheaper in first cost and retains its shape better than the rectangular furnace. A furnace recently constructed has an oval shell 24 ft. 2 in. by 15 ft. 7 in. in outside dimensions. The crucible itself is 19 ft. by 10 ft. 5 in. inside measurement. The bottom consists of 8 inches of silica sand on top of which is a three-foot thickness of carbon blocks with the joints rammed with crushed carbon and pitch. The side walls consist of a 9-inch firebrick lining followed by an 18-inch rammed carbon lining. The crucible of this furnace is three feet deep. There are two inches of silica sand between the firebrick and the steel shell. This furnace operates with six 24-inch round amorphous carbon electrodes, two on each phase, in a common holder. The no-load voltage is 116 volts, and the input 3600 kw. When treating a carbonate ore containing 37% manganese this furnace has produced 16 short tons of ferro-manganese of 80% grade per 24 hours with a recovery of 70%.

Design of Electrode Holder

Nothing about an electric furnace requires more careful design than the electrode holders. Two types of holders are in use; top holders and side, or slip holders. When top holders are used the electrode is gripped at the top and when too short the butt is removed and a new electrode with holder installed. The slip holder is designed to permit of screwing on additional sections of electrode and so avoiding the waste occasioned when a butt is discarded. In practice there is greater economy in using a top holder and discarding the butt. In an open-top furnace where the electrodes are buried in the charge, the difficulty with joints is considerable, and more waste is likely to result from breakage than would result from discarding the butt where the top holder is used. In general, simplicity, reasonable flexibility and ample contact are the prime requisites in a holder. Screws can only be used where they are water-cooled or pass through a water-cooled section and are not required to carry current. Provision should be made for attachment of cables without bringing them out over the top of the furnace where they will be subjected to the effect of the hot gases. The transformer should be located as close to the furnace as is practicable in order that the drop between transformer and furnace may be a minimum.

Type of Electrodes

Amorphous carbon electrodes are ordinarily employed in ferro-manganese furnaces. It is customary to use electrodes of such size that the current density does not exceed 25 amperes per square inch. In my opinion a better rule for ferro-manganese furnaces would be to allow not less than one square inch of electrode area for each 0.75-kw. input. For example, if we consider a furnace operating at 68 volts with 19,600 amperes per phase and 1650-kw. input, according to the first rule we require 784 square inches of electrode cross section per phase; by the second rule the result would be practically the same, 735 square inches. If, however, an attempt is made to operate the furnace at higher voltage, it will be found that the load in amperes does not increase in direct proportion to the voltage increase, and the second rule appears more logical. In other words, the electrodes should be proportioned on the basis of energy density rather than on the basis of current density.

The Soderberg Electrode

The greatest single advance that has been made has been the Soderberg self-baking electrode. The first installation of this electrode in this country was

made in June of this year at the plant of the Southern Manganese Corporation at Anniston, Alabama. This installation has been described by Dr. J. W. Richards in the several papers recently presented by him before the American Electrochemical Society, and need not be discussed here. The Soderberg electrode eliminates breakage, and practically does away with the loss of electrode occasioned by the erosive action of the hot gases above the charge line. At the time of my visit to the plant of the Southern Manganese Corporation, a furnace equipped with these electrodes had been in continuous operation for three weeks with only ten minutes delay in any way due to electrode troubles, and this delay was due more to furnace condition than anything else.

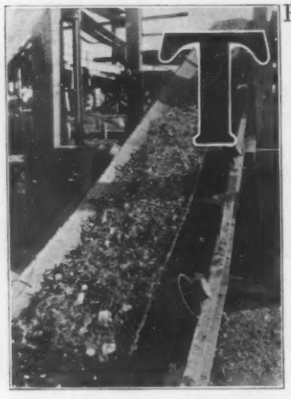
Automatic regulators are now in use in the larger furnace installations, and are operating very successfully. In some plants these regulators are actuated by changes in current per phase through transformers placed either on the low or high tension busses of the furnace transformer. In others changes in voltage to ground are employed to actuate the mechanism that raises or lowers the electrode. The latter method is most logical and satisfactory from an operating standpoint.

Outlook for the Future

Whether the electric furnace can compete with the iron blast furnace when conditions again become normal is very problematic. It does, however, appear that some ferro-manganese will continue to be produced in this manner. It should be borne in mind that the design and operation of electric furnaces are not electrical problems alone. They are also metallurgical problems. This is equally applicable to all electric furnace work. Many failures have resulted and much money has been wasted through failure to realize the importance of the metallurgical side of the problem.

Electricity in the Sugar Beet Industry

(A twenty-one million dollar crop of beets in Utah and Idaho, in one season, makes the beet sugar industry an important one in the intermountain district. The following article describes the process of beet-sugar making, and the electrical equipment used in the factories. —The Editor.)



Conveyor transporting dirt from beets back to wagon

THE significance of the sugar beet industry, and its importance to the intermountain country as a whole, and to Utah and Idaho particularly, may be realized from the fact that for the 1920 season the disbursements for beets, at $12.00 per ton, amounted to over $21,000,000. This is the one major agricultural product of Utah and Idaho which has not depreciated very materially from the prices obtained in 1919.

The use of electric power in this vast industry is increasing each year, although it has been a comparatively short time since central station engineers began to realize that electricity—and purchased electricity at that—could be used with economy in the manufacture of beet sugar. The extensive use of steam motive power in sugar factories is due to the fact that enormous quantities of steam are used in the sugar-making process for cooking, evaporating, etc., and relatively small quantities for power purposes. Numerous advances in the art of sugar making have been made each year, the changes in the power application in the older factories usually resulting in the use of purchased electricity.

The first step toward supplying sugar factories with electric power was made by central station companies, who furnished electricity for lighting, machine shop power and fire protection during the non-sugar-making season. This small beginning has grown until at the present time practically all the sugar factories in the intermountain territory are using from 50 to 250 horsepower each in their operations. A sugar factory power load is of low yearly load factor, the heavy operating season extending over a period of only 120 to 150 days. During the sugar-making season, however, the process is such that only continuous operation is economical.

Cleaning and Shredding Beets

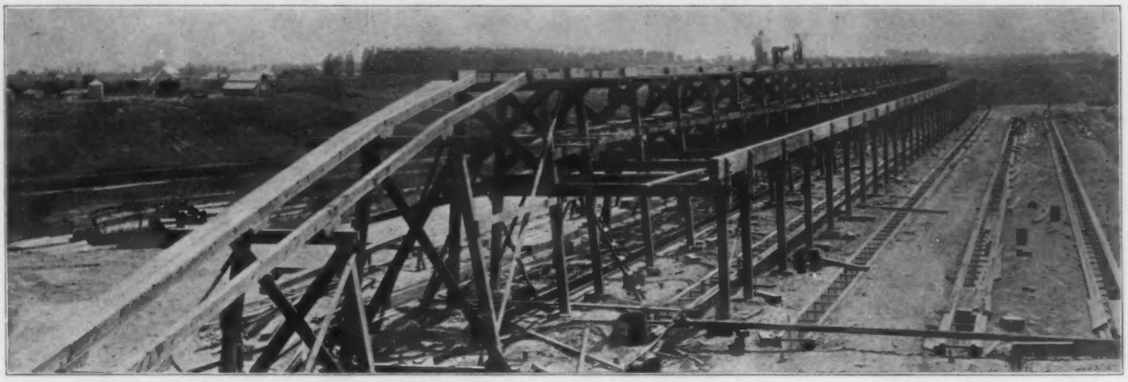
The sugar beets, after being taken from the ground, are hauled to the factory and placed in sheds or bins. These are equipped with bottoms built in such a way as to cause the beets to feed by gravity toward the center of the bin to a flume which extends through the center the entire length of the shed. Water turned into the flume conveys the beets from any particular bin to the factory, and washes them en route. Entering the factory the beets are topped, and rocks and other foreign substance removed mechanically, after which the beets are washed again in running water and conveyed to the cutting machines. These machines consist of 12 to 14 large knives which shred the beets into thin corrugated strips so that a large surface is exposed. The strips are dumped into the diffusion battery which consists, depending upon the capacity of the factory, of twelve to twenty cells, each 8 feet long by 4 feet in diameter, arranged so that the juice may be circulated in series. Any individual cell may be cut out while being emptied or filled.

Treatment of Beet Juice

Hot water is forced through the cells, cooking the beets and extracting the juice. The juice is weighed, sampled and tested mechanically, after which it is purified in lime fumes or has milk of lime added. This precipitates certain impurities which are removed by filtering. The thin juice is then

evaporated in multiple effect evaporatories, either triple, quadruple or quintuple. The juice is boiled by steam in each cell, the steam from the first cell being exhausted into the next, and so on, the last cell being under as nearly perfect vacuum as can be maintained by a jet condenser. The warm water from the condenser is used in the flume for conveying the beets from the sheds to the factory and in washing them.

The juice then receives more treatment in the lime fumes and sulphur-dioxide for clarifying, treatment being varied according to the chemical composition of the juice. After clarifying it is pumped to the sugar pans which are multiple effect evaporators having glass covered openings for the observance of the process. The operator of these pans judges from the chemical reports previously made, as well as from the appearance of the syrup, the temperature and pressure to be maintained in each cell. The vacuum on the last pan is maintained by a jet condenser similar to the one on the evaporators, the vacuum being varied so that the thick syrup will boil and grain, and still not melt the sugar crystals which are forming. When the operator decides the crystallizing process has gone as far as advisable with the assurance of pure sugar, the mixture of sugar and molasses is dumped into centrifugal extractors, operated by water pressure, and the syrup taken from the sugar. The sugar is then washed with hot water and dried in a cylindrical revolving screen, after which it is sacked.



Main conveyor high line in course of construction. This carries the beets from a pit to the sheds, where they are dropped into bins.

Additional Process for Syrup

The syrup from the white sugar process contains considerable sugar. It is thinned and put through a similar purifying and graining process as before, the resulting mixture having fewer sugar crystals. This mixture is allowed to cool for several days. While cooling it is stirred mechanically, causing the sugar crystals gradually to increase in size and number. After cooling, the sugar is extracted by a process similar to that employed previously except in the length of time required. The resulting sugar is brown and is not pure. It is dissolved in hot water and added to the fresh juice from the diffusion battery and put through the factory again.

The syrup resulting from the brown sugar extraction contains some sugar, but also contains so many impurities that the sugar cannot be made to crystallize. This syrup is treated chemically, a compound of sugar and lime being formed. This compound is then used for the first purifying of the fresh juice. In this manner practically 95 per cent of the sugar is saved.

Power Requirements

Power is required for beet handling machinery, slicers, centrifugals, granulators, crystallizers, sewing and washing machines, sugar stackers, shops and various pumps. In the past all factories were built with steam drive, but the experience of the factories in Utah and Idaho has demonstrated very clearly that electric power is the more economical for all the auxiliary apparatus such as beet-handling machinery, machine shop, line-handling machinery, etc. Some application of motor drive has been made to isolated pumps where the loss due to steam condensation in a long pipe was great. A totally electrified factory would show a large saving over the present method of direct steam drive, due to lessened investment and the ease of shifting the method of drive and changing type of machines or processes, even when the electricity is generated on the premises. A factory now in operation in the southern part of Utah is entirely motor driven, electricity being generated by a steam turbine. By purchasing electric power the investment in generating equipment is, of course, eliminated.

Due to the fact that power requirements are much in excess of steam requirements, special economy is found in purchased electricity for the operation of the slicing stations or substations to the main factories, where the beets are merely sliced and cooked and the juice pumped to the factory.

Origin of Beet-Handling Machinery

The beet-handling machinery which is operated at all factories without exception by purchased electricity is of rather recent and interesting origin.

The manager of one of the factories desired some form of apparatus for removing the dirt from the beets before they were weighed and put in the sheds. There were three reasons for this: first, the farmer was paid for the soil that was weighed, at the

price of beets; second, the removal of this soil was a detriment to the sugar beet land; and third, the soil on the beets in the sheds caused fermentation. In order to accomplish these results efficiently it was also necessary to have a device for distributing the beets in the sheds. A conveyor was designed and placed in operation, the beets being dumped from a wagon into a pit containing a steel apron conveyor which carries the beets to a revolving screen. In this screen the dirt is shaken off the beets and conveyed back to the wagon, for the farmer to return to the land. The beets are dropped down a chute from the screen to a 30-inch rubber belt which extends over the full length of the beet sheds, usually 300 to 600 feet. The beets are elevated on this belt and carried along over the sheds to the bin which is to be filled. The main belt passes over a "tripper" which can be moved lengthwise of the belt in either direction. When the beets reach the "tripper" they are dumped either into the bin directly beneath the main belt or on to a cross belt conveyor with another "tripper" on it. This cross conveyor fills the bins not directly beneath the main belt. The motive power of this equipment consists of one 10 to 15-hp. motor on the screening equipment, one 20 to 50-hp. motor on the main conveyor belt, and one 5 to 10-hp. motor on the cross conveyor. Quite a number of the factories in Utah and Idaho have installed equipment similar to the above, in addition to their other electrical equipment.

Industrial Development in British Columbia

BY HUGH DALTON

(In the upbuilding of the Pacific Coast, British Columbia with its great abundance of resources is playing an important part. A brief survey of the industrial growth and possibilities of the region is here presented by the secretary of the British Columbia Canadian Manufacturers' Association.—The Editor.)

There are on Vancouver Island approximately 75 industrial establishments, employing about 21,000 employes and having a pay roll, for last year, of $25,635,000. Included in the products of these industries are:—

Anchors, asphaltum, awnings.
Bags, barrels, bedding, boats, biscuits, boxes (wood and paper), brick, building-paper.
Chemicals, cement, cereal products, clothing, coal, coal-tar products, condensed milk.
Fish products, floor coverings (from sawmill waste), furniture.
Harness.
Ink, jam, lumber, lye and cleansers.
Machinery of all kinds, mattresses, paint, pipes of cast iron.
Pulleys, pumps, roofing, sails, shingles, ships, stoves.
Stucco board, tanks (steel), soap, tiles, tin cans, toys.
Vinegar, varnishes, whale meat, wood pulp.

The annual production of the industries of the island have an aggregate value of about $45,000,000. For the most part the plants are small, the output being absorbed by a population confined to Western Canada. Gradually, however, preparations are being made for an extension of the export field. There are between 750,000 and 1,000,000 acres of arable land on Vancouver Island, the climate of which is encouraging to agriculture.

Development of Vancouver City

Vancouver, the largest city in British Columbia and the fourth in size in the Dominion, is located on Burrard Inlet, about 25 miles north of the international boundary. As a shipping port it has developed amazingly during the past ten years. New piers and harbor facilities, involving the expenditure of $20,000,000, are under way and are being pushed to completion, in accordance with the national scheme of trade development.

Regular steamship lines operate to Alaska, California, China, Japan, New Zealand, Australia and the ports of Great Britain and Europe, while with the completion of the government fleet, 16 additional boats will be placed in service between Vancouver and distant ports. Included in the plans of the government are lines to South America, India, South Africa and the Orient. The boats to be used by the government are the big 8,800-ton steel freighters constructed in British Columbia yards and given the highest rating at Lloyds.

General Industrial Growth

British Columbia has made rapid strides as a manufacturing province. In 1900 there were but 71 industries in the city of Vancouver. In 1917 there were 678, and this number has been increased by more than 200 since that time. There are more than 1,700 manufacturing establishments in the province, and in addition there are many connected with lumbering and mining that are not included in the total. Some of the important factories are:

Airplane builders	1
Boots, shoes, gloves, harness and tanners	15
Building supplies and materials	121
Chemicals and explosives	14
Cordage	1
Drydocks	3
Fertilizers	16
Fish canners and packers	127
Food products	432
Metal products, about	200
Printing and office supplies	124
Pulp and paper	7
Ship and boat builders	56
Textile products	78
Miscellaneous	92

Mining Activity

The mines of British Columbia are well known. The Britannia Mines, located 35 miles from Vancouver, are the largest copper properties in the British Empire. The Hidden Creek Mines supply the ore to operate the Granby Company's smelter at Anyox. Other coast mines which are producing are the

A large paper mill at Ocean Falls, an ideal location from the standpoint of power supply, raw material and shipping facilities

Premier at Stewart, Dolly Varden at Alice Arm, Drum Lummon at Hartley Bay, and Marble Bay at Van Anda.

Pulp and paper mills are located at Ocean Falls, Powell River, Port Alice, Quatsino and Howe Sound.

At Trail are located the works of the Consolidated Mining & Smelting Company, where five different metals are smelted and refined, creating a record unique in the treatment of ores. Gold, silver, copper, zinc and lead are extracted from the rock in this great plant, which draws its supply of ores not only from its gold mines at Rossland, seven miles away, but from the whole of the interior country. Power for the big smelter at Trail, for the Canada Copper Corporation's big mines at Copper Mountain and the concentration plant at Allenby, is obtained from Bonnington Falls, one of the greatest water powers in America. It has been termed the "Nerve Center of the Interior," and is capable of developing more than 200,000 hp. About 40,000 hp. is being used today, supplying factories and furnishing power for mine operations and electric lighting. The coal mines at Coalmont are run by Bonnington Falls, more than 150 miles distant.

Nelson, on the Kootenay Lake, is the largest inland town in British Columbia. It has several large industries and is the business center of a large section of the province.

Imports are mainly iron and steel, machinery, rice, sugar (raw), tea, coffee, spices, and certain foodstuffs. The volume of imports of food is decreasing with increased production from the land.

Increased Demand for Electric Power

Indicative of the call for electrical service which this development entails, is the power company's report that in the five months from December, 1919, to April, 1920, there was an increase of 500% in the load contracted for, as compared with the same period 1918-19. During this period 110 new power accounts were opened and 220 motors connected, while the power generated increased by 28% over that generated during the same period 1918-19.

HOW TO CHOOSE AN APPLIANCE FOR A SALES CAMPAIGN

The characteristics which an electrical device must have in order to be handled profitably in large quantities have been analyzed by a Western power man whose company is extensively interested in the merchandising field. These requirements are of interest to all who are selling electrical goods, as well as to manufacturers. Here they are:

1. The device must be carried as a permanent line by a reliable manufacturer. This insures being able to replace parts and make repairs when the customer requires such and also gives a continuing value to any advertising which the retailer may do, which otherwise would lose its proper cumulative effect.
2. It must give satisfaction. That is to say, a power company could not afford to put an appliance on the market while it was still in the experimental stage and not yet a reliable product. A customer once lost is doubly hard to sell a second time. It was this element which delayed the electric range business for so long until the apparatus was perfected.
3. It must have one or more sales points. An electric iron, for instance, must be advertisable not merely with arguments on the general subject of the benefits of electricity—it must be an electric iron with special advantages which can be pointed out, talking points for salesmen.
4. The manufacturer and jobber must give support through men in the field and must cooperate in the service given customers.
5. The device must be adequately advertised by manufacturer and jobber, not placing all the burden upon the retailer. Aside from the expense involved in local advertising unsupported, such advertising in no way can be said to take the place of a national broadside which gives the customer the impression of reliability and permanence, a matter of great importance in purchasing any article which costs more than a few dollars.

This analysis may perhaps impose requirements which would be somewhat drastic for a local dealer in passing upon all the articles he may carry in his store, but for anything like a campaign, they will be found fairly sound and can be studied with profit by manufacturer and merchandiser as well.

Terminal Facilities to Increase Foreign Trade

BY GEO. F. NICHOLSON

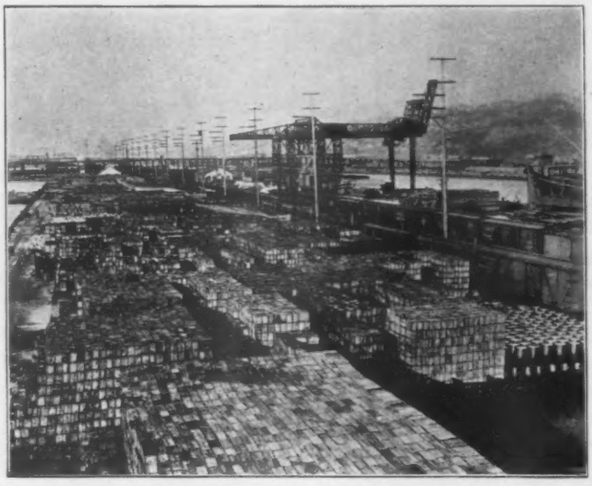
(The industrial and commercial development of the Pacific Coast are closely bound up with trans-Pacific trade, and the importance of adequate modern electric terminal facilities in this connection cannot be over-estimated. The following discussion of port improvement as applied to the Pacific Coast, is by the chief engineer for the Port of Seattle.—The Editor.)

Our ports are the weakest link in the chain of transportation and constitute barriers, in the transshipment of freight, that hamper foreign trade. Therefore it is not surprising, in connection with the operation of marine terminal facilities, that modern mechanical freight handling equipment is of first importance.

Heavy Equipment

Considering the heavy handling equipment, the locomotive crane is probably the most popular piece of equipment for handling heavy export freight in connection with the operation of the open wharf, both in loading and unloading of ships and in the assembling of cargo of this character on the wharf. Being portable, these cranes also are useful in the piling of heavy materials on open storage property in the vicinity of the terminals.

In the operation of Pacific Coast ports a large capacity crane on one or more of the terminals is most essential for the handling of extremely heavy lifts. Where the ship is discharged or loaded at the wharf, as is the case on the Pacific Coast, the type of crane installed should be the heavy handling stationary revolving type, which will enable heavy loads to be transferred between railroad car and ship; also heavy loads can be placed at any location on the wharf for long term storage within the radius of the crane.



Five million cases of vegetable oil stacked on the municipal pier in Seattle. In handling this important item of Oriental import, special machinery for warming the oil and pumping it into tank cars is required. In the background is shown the approved type of gantry bridge crane with locomotive boom for handling lumber and other bulky cargo.

Powerful electric magnets are now being put into use in connection with the operation of marine terminal facilities and can be operated in connection with either locomotive or gantry crane. They are especially desirable on the Pacific Coast, where a great quantity of steel and iron are shipped to the Orient.

By use of such a magnet in Seattle a car of steel plates was unloaded in one hour with the use of the locomotive crane and one operator, whereas formerly, with the sling method, it required three additional men in the car and took six hours. Also two cars of scrap iron have been unloaded in one hour, which formerly took eight hours.

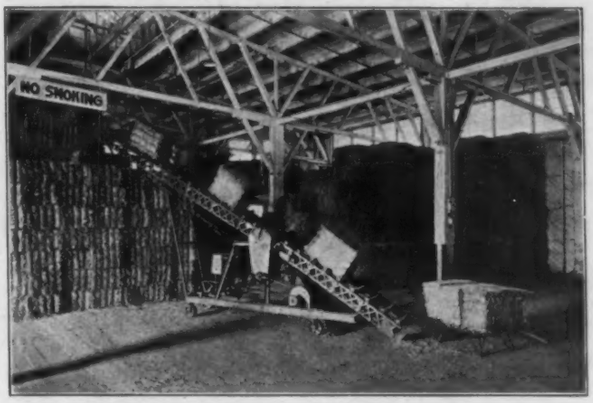
Light Handling Equipment

While much has been accomplished in the handling of heavy export freight by the introduction of freight handling machinery, slow progress has been made in the handling of our import cargoes from the far East and Alaska, consisting of bags, bales, boxes, bundles and sacked commodities, each shipment containing countless markings and different sized packages. Except at a few of our Western cities and some of the U. S. war bases of recent construction, little has so far been accomplished toward modernizing terminals for the handling of import freight, and it is a matter that deserves immediate attention.

The handling of miscellaneous freight requires a combination of specialized machinery, and fixed telpher or overhead monorail systems with various types of movable carriages will not solve the problem of handling our mixed cargo. It requires the portable class of devices now offered by manufacturers and specialized equipment constructed by our Harbor Boards for this work; such appliances as sectional power conveyors, sectional gravity carriers, gravity chutes, pilers and tiering machines; platform lifting trucks, etc. Freight may be taken from the hold by means of an elevator conveyor and thence by power conveyors to the place of rest in the transit shed, where it is piled by means of an inclined power conveyor. Again, another cargo may be handled in the same manner from the vessel, but it may be more economical to handle the latter from shipside by means of tractors and 4-wheel trailers to the pile in the shed or warehouse, where it is then tiered by stacking elevators. In all of these combinations of machinery that may be used to the best advantage in the handling of miscellaneous cargoes, it will always be noted that it is portable equipment. Even the power conveyors are short sectional conveyors that can easily be moved about the shed or warehouse. This is the first requirement that is necessary in connection with the use of these handling devices and semi-portable or stationary class of equipment, with the exception of the stationary electric freight elevator and built-in gravity and spiral chutes, cannot be successfully used in connection with the handling of our miscellaneous import freight.

Electric and Gas Tractors

Electric tractors and industrial load carrying trucks and trailers, working together with piling machines, are going a long way toward solving the

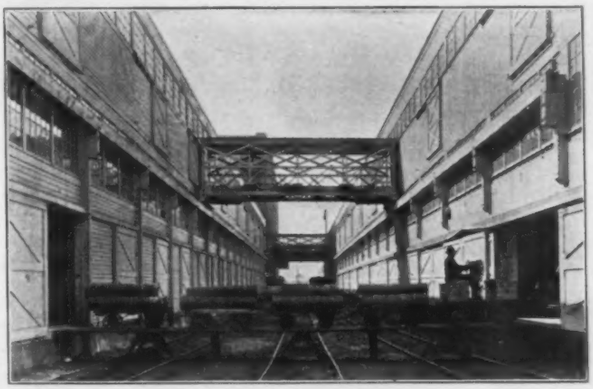


Stacking hay eleven tiers high by portable electric conveyors in the Hanford St. transit sheds, Seattle. Portable machinery has the great advantage of flexibility and may be used in various combinations to meet the diverse problems of cargo handling.

problem of freight handling, showing a great saving in operating costs and giving greater speed, thus resulting in greater capacity in a given area of floor space. Electric or gas tractors with trailers, where the transfer distance exceeds 150 feet, should replace the hand truck in almost every instance. One machine occupies very little more space than a man with a hand truck, and carries 4,000 lbs. or the equivalent of 6 to 10 men with hand trucks. It operates with a speed of 5 to 8 miles per hour when loaded, as compared with a man at 1 to 1½ miles per hour.

Savings in Costs

The cost in handling cargoes in Seattle is being greatly reduced by the full use of mechanical equipment. Practically all freight is carried by tractors



The electric truck is invaluable in supplanting man-power for transportation. The Port of Seattle has arranged its warehouses and transit sheds in close conjunction, so that cargo may be taken directly from carrier to warehouse. Portable bridges span the tracks.

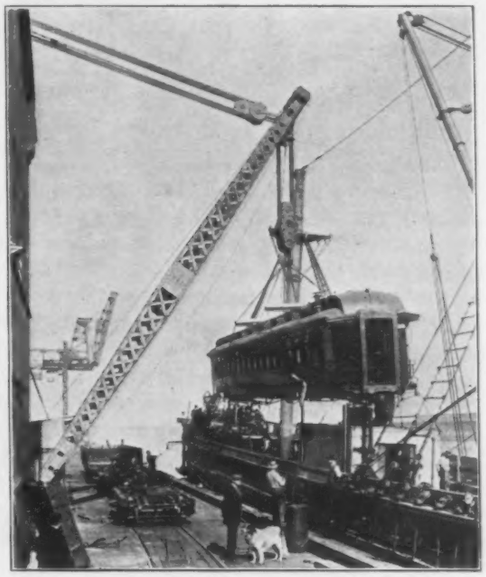
and trailers or conveyors, and when delivered to the pile is stacked by power conveyors or tiering machines, doing away with the old method of man-handling.

The Port's object is to eliminate as far as possible the old two-wheel trucks, and the results show that in many cases these handling costs have been reduced from 30 to 50%. In the loading of gunny bales in railroad cars a reduction from 50c. to 26c. per ton was made by the use of stacking elevators. In the discharging of pineapple from ship to wharf, the handling cost was reduced from $1.00 to 35c. per ton with the aid of tractors and gravity roll conveyors. Sacked cargoes have been handled by tractors and trailers together with power conveying machinery at 40% to 50% less than formerly. The equipment engineer's work is to analyze a ship's manifest before cargo arrives in port, assemble such equipment as is best suited for such cargo before ship arrives, and see that it is put into maximum use. The equipment engineer is also looking after the safety of the operators and users of this equipment, and a campaign of educational standards is being carried on, and to date very few accidents have occurred.

Need For More Labor-Saving Devices

It is the use of light portable handling equipment, such as ship conveyors, sectional power conveyors, electric tractors and trailers, working in conjunction with incline power conveyors and portable stacking elevators, that will solve the handling of our miscellaneous and import cargoes on the Pacific Coast.

The final word may be to point out the great need for more labor saving cargo handling machinery. A port may have fine natural advantages, splendid modern up-to-date terminals of the best plan and construction, but unless it offers mechanical appliances in sufficient amount to handle large car-



A 125-ton steel shear leg derrick loading a shipment of railway equipment direct from car to ship at Smith Cove Pier "A," Seattle. Practically all heavy material for Japan and Russia is handled by this crane.

goes quickly and cheaply, it has failed then in the most essential point in terminal construction. Let the Pacific Coast ports profit by the mistakes made by their elders, the great salt water ports of Europe and our Atlantic seaboard.

Advances in the Electrical Manufacture of Paper

(The growing demand for electric drive in industrial plants leads to constant improvement in the design and efficiency of equipment. The following article describes the new sectionalized drive which has recently been installed with unqualified success in a Northwest paper mill. —The Editor.)

The electrical operation of paper machines during the past has been practically confined to the use of a single unit, either belted or direct connected to the variable speed line shaft. Speed range was obtained by a combination of field and voltage on the motor which was driven from a generator either belted or direct connected to the steam engine driving the constant speed shaft. Sectionalized drive has not been used possibly because the trade has not demanded it, and the speeds at which paper machines have been run, hitherto have not made it necessary.

The demand for high speed paper machines and the difficulty of using a mechanical drive have focused attention on the sectionalized drive and made it practically necessary to meet the demands of the trade. Other features which favor the sectionalized drive are the elimination of the line shafts and belting and the saving of space. It is particularly adaptable to mills where the paper machine is on the floor and although such a drive will eliminate the necessity for a basement in the mill, this is not considered an advantage by all paper manufacturers.

Site of extension of the Crown Willamette Company's mill at West Lynn, Oregon, where the first sectionalized drive equipment has recently been put into operation with complete success.

Equipment for Sectionalized Drive

The sectionalized drive developed by the General Electric Company consists of one unit for each section of the paper machine. Each unit consists of a direct current motor and synchronous motor of about 20 per cent of the capacity of the direct current motor, the synchronous motor being driven from the direct current motor through a gear reduction and a set of cones, which permit of a total range in speed of 12 per cent. The motors and cones are mounted on a common base and direct connected to the section of the paper machine.

All the motor units are driven from a single generator, on which the voltage is varied by means of field control to obtain a variation in speed on the paper machine. For ranges in speed not exceeding 6 to 1 field control on the motors is not necessary, but beyond this range a combination of voltage and field control is necessary to insure good speed regulation.

All direct current units are operated in multiple from the generator bus. All synchronous motors are connected to a dead bus. All direct current motor field and synchronous motor fields, also the generator field, are connected to the exciter bus, which is of sufficient capacity to excite all machines.

Each direct current motor has a drum controller and rheostat in its circuit for individual starting, the last point of this controller being in the auxiliary circuit of the contactor which connects the synchronous motor to the dead bus. The actual closing of this contactor is by means of a push button, but it can only be done when the controller is on the last point.

Control Arrangements

The control of this equipment is very simple and similar to the standard paper machine drive of the past. The auxiliary control panel which controls the speed of the entire paper machine as a unit consists of a small panel on which is mounted one speed indicator, one 9-in. rheostat hand wheel, and one push button station for start and stop duty. In addition to the above control there is a small indicating panel for each section.

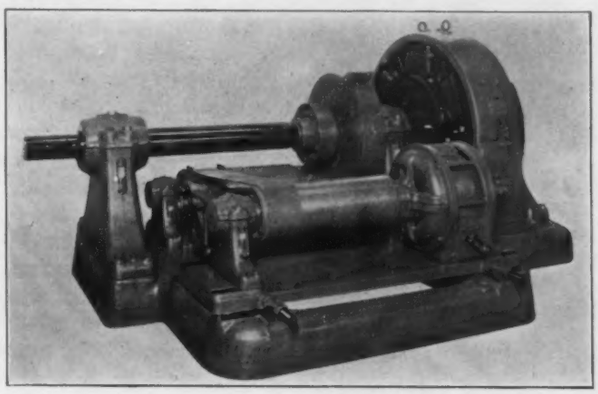
When starting the paper machine as unit the drum controllers in the d.c. motor circuits should all be on the last point with the synchronous motors connected to the dead bus. The start button on the auxiliary control panel will close the line contactor on the motor generator panel and apply a low voltage to all the d.c. motors and turn them over at a slow speed. The synchronous motors being geared and belted to the d.c. motors will also turn over with them, and since they are all connected to the same bus they will start up in synchronism.

To bring the machine up to speed the generator field is strengthened by turning the hand wheel on the auxiliary control panel.

Relative Speed of Sections

To make paper successfully the relative speed of the various sections must not change; i.e., the motors must be synchronized and free from any individual change in speed. This is the function of the synchronous motors, and within their capacity they will absolutely hold the d.c. motors in step. The speeds of the different sections of the paper machine are not all the same, as there is a slight increase from the wet end to the dry end, and this percentage difference may vary slightly for different grades of paper and under different operating conditions. This variation is called "draw" and is taken care of by shifting the belt on the cones, a procedure which can only change the d.c. motor speed since the synchronous motor speed is fixed.

Under actual operation any change in the load on a particular section, caused by changing the weights or otherwise altering conditions, will be absorbed by the synchronous machine. If the load increases it will act as a motor to aid the d.c. motor on that particular section, and draw its power from the remaining synchronous machines which will immediately act as generators, and distribute the load over the entire machine drive. If the load decreases



A 100-hp. motor with sectional drive, as used in the Crown Willamette paper mill

it will act as a generator and supply power to the remaining synchronous machines which then act as motors. Any change in load on any section is therefore distributed over the whole motor equipment, and may change the speed of the paper machine as a whole but cannot cause any change in the relative speeds of the various sections.

So long as any synchronous machine operates within its capacity either as a motor or as a generator it will not be necessary to make any adjustments, but if the indicating wattmeter in the synchronous machine circuit shows too much power it may be easily brought back to zero by turning the rheostat in the d.c. motor field.

Automatic or Hand Control

The equipment described above is what is termed hand control, but this term applies to the sectional panels and not to the main control panel, since all adjustments of power and transfer of energy between the direct current motors and their corresponding synchronous motors is accomplished by hand. It is not considered essential to make this adjustment automatic, as the indicating wattmeter in the synchronous motor circuit plainly shows whether the synchronous motor is acting as a motor or a generator, and how much power it is delivering. As long as it is operating within the prescribed limits no adjustments are necessary.

However, the automatic feature is readily obtainable by the addition of a motor operated field rheostat for the direct current motor, this rheostat being actuated by a contact-making wattmeter in the synchronous motor line. This consists of an enclosing case containing the motor operated rheostat, a contact-making wattmeter, and the relay for operating the rheostat motor. The so-called automatic control has all of the features of the hand control.

ELECTRIFICATION OF POLISH INDUSTRIES

One of the most cherished ambitions of the industrial leaders of Poland is the projected electrification of the principal industries. Now that Poland is an economic as well as a political unit, it is expected that the project will be pushed.

The domestic production of electric manufactures in Poland is in its infancy. According to the last statistics available, there were twelve plants making electrical supplies, employing about 1,200 workmen. These factories manufactured detail and supply apparatus, electrical motors, cable filament, carbon lamps, coal for arc lamps, insulating tubes, and similar products.

The realization of this scheme of electrification, it will be seen, must depend upon the success which meets the efforts of the government and trade organizations to enlist the support of foreign electrical interests.

Electrification is essential to the modern development of the coal mining industry in Poland. The possibilities of this industry may be gauged from the extent of the coal reserves in the Polish fields. It is estimated that the mines contain approximately 94 1/3 billion tons of coal. The fields cover an area of about 2,320 square miles, and in pre-war years had an annual production of more than 50 million tons. This may be compared with the production of the state of Pennsylvania, which amounted to about 81 million tons.

In the coal industry the first electrical problem that presents itself is the development of electrical power in the Polish Silesian coal fields extending to the main industrial centers in the vicinity of Lodz and Warsaw, a carrying distance of between 120 and 180 miles. This will permit not only the control of electrical power distribution in the mining district, with its numerous industrial establishments, but it will also permit supplying other industrial and agricultural establishments throughout the country.

The sugar industry offers another great field for electrification. There were in former Russian Poland alone in 1912 51 beet sugar factories and refineries, with a yearly production of 72,646 tons of raw sugar and 54,407 tons of refined sugar. The more recently erected factories are of the most modern design. The older ones are being gradually transformed according to the latest requirements, which include an electric drive by exhaust steam turbines. In the Ukraine, where the sugar industry is highly developed, many of the factories are in Polish hands and receive their technical supplies from Poland. These Ukrainian sugar factories in consequence of difficult labor conditions will have to introduce modern systems and electric machinery of the most improved design. The Ukraine will be an important market for the Polish electrical industry.

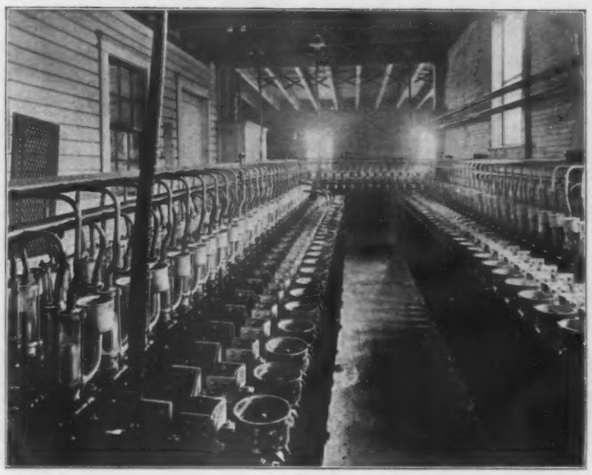
But little effort has veen made to develop hydroelectric power in Poland, and this represents a tremendous field for the American investor. According to the most recent calculations the hydraulic force in Galicia alone amounts to 890,400 hp., of which only 35,000 hp. has been developed.

Electrometallurgy and Electrochemistry in the West

BY L. W. CHAPMAN

(The mineral wealth of the West, combined with cheap hydroelectric power, tends to give the electrometallurgical and electrochemical industries an important place in Western industrial activity. The following article, by the Western Editor of Chemical and Metallurgical Engineering, takes up some of the most important phases of this development and the future outlook. —The Editor.)

Modern industry demands high grade products, many of which are obtained through electrochemical or electrometallurgical processes. Industry is also dependent upon materials that can be produced only by one or the other of these processes; and thus electrochemistry and electrometallurgy are playing a prominent part in the industrial development of the country, and will become increasingly important factors in aiding the industrial growth of the West, because of the large and varied supply of raw materials and the great amount of available water power in this region. Processes using electric current will not only supply the superior products which are needed, but, by making possible the recovery of copper, zinc and other metals from low-grade complex ore deposits, will increase the value of western mineral resources.



Installation of electrolytic oxygen and hydrogen cells of the Portland Oxygen & Hydrogen Company at Portland, Ore. Fifty thousand cubic feet of oxygen are produced per day.

Many Electrometallurgical Plants

In the refining and winning of metals by electrolysis, electricity has an essential place in western metallurgy. There are three electrolytic copper refineries in operation having a yearly capacity of over four hundred million pounds, the largest plant being that of the Anaconda Copper Mining Company at Great Falls, Mont., with a capacity of half the total. Other plants are located at Tacoma, Wash., and at Trail, B. C. Electrolytic refining of lead is carried out at Trail by the Consolidated Mining & Smelting Company of Canada, Ltd. The operation is very successful, the cost of refining per ton being less than in pyrometallurgical plants of similar size. At the San Francisco Mint there is an electrolytic gold refinery.

One of the most important recent developments in the winning of metals by electrolysis is the recovery of zinc. Some ores containing lead and zinc can be treated economically by this method only; good recoveries of both metals are obtained. A very large electrolytic zinc plant, owned by the Anaconda Copper Mining Company, is located at Great Falls, Mont. The plant has a capacity of 150 tons of zinc per day, and uses 35,000-kw. generator capacity. There is a 75-ton plant at Trail, B. C., a 15-ton plant at Park City, Utah, and several experimental plants. The Bunker Hill and Sullivan Co. has announced its intention to build an electrolytic zinc plant with an initial capacity of 50 tons per day at Kellogg, Idaho, to treat ores from the Coeur d'Alene district. At Ajo, Ariz., there is a large plant for the recovery of copper from oxidized ores by electrolysis of the solution obtained by leaching the ore with sulphuric acid. The plant has a capacity of 5,000 tons of ore per day. Cadmium is being recovered from by-products at Midvale, Utah, and has been recovered at Bully Hill in California; the operations are small but the metal is essential as a component of the alloy used for the link in sprinkler heads, and has other important uses. The variety and size of these operations indicate the importance of electrical energy in the production of some of the essential non-ferrous metals.

Electric Furnace Processes

With the exception of the production of cadmium and the refining of gold the operations mentioned are necessarily carried out on a large scale, and the plants are located near the mines supplying the ores from which the metals are obtained. Electric furnace and electrochemical operations are, on the other hand, carried out near industrial communities; if there be near a supply of cheap water power, as at Niagara Falls, it is a decided advantage. It would seem that there is a probability of a large and increasing demand for power for electric furnaces, for the electrolytic production of oxygen and hydrogen and some other electrochemical processes throughout the West.

In most of the cities in the West there are electric furnaces for the production of steel, and there are several installations for the melting of brass and other alloys. Steel made in the electric furnace has superior qualities which offset any disadvantages of high power cost. The increasing cost of fuel oil and coal has a tendency to increase the number of such installations. The demand for the best grades of steel for industrial purposes will also result in an enlarged demand for ferro alloys, and in the production of these alloys the electric furnace is often the only metallurgical tool that can be used. Most of the important ferro alloys have been produced in

the West. There is a large ferromanganese plant at Great Falls, Mont., operated by the Anaconda Copper Mining Company. Ferromanganese has also been produced at Tacoma, Wash., Portland, Ore., at Bay Point and Heroult in California. Ferromolybdenum, ferrotungsten, ferrovanadium have been produced in Colorado and elsewhere. The demand for these alloys decreased after the war, and this, together with a reduction in price, has prevented continuation of most of the operations. This condition is to be considered but temporary, and when business conditions are normal the ferro alloy industry will again become active. A considerable increase in the use of electric furnaces is to be expected in the production of iron castings from scrap, either directly, or for refining the product from a cupola furnace.

For the melting of brass several successful types of electric furnaces have been brought out. These not only produce a more uniform product and a better grade of casting, but are more economical of metal. Such furnaces form a desirable load for power companies and with the relief of the present power shortage a considerable increase in the use of electricity for this purpose may be expected.

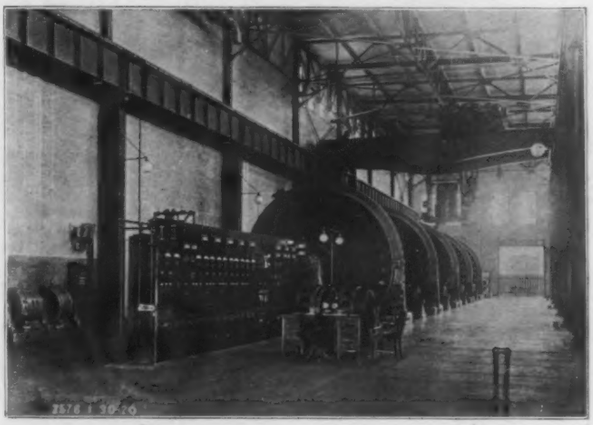
Electrolytic Chemical Production

Hydrogen is used in the hardening of vegetable oils, and Oriental oils are readily available at Pacific Coast ports. The high price of animal fats has increased the demand for the edible products made from vegetable oils by hydrogenation. The most convenient way to produce the hydrogen is by the electrolysis of water. Electrolytic oxygen and hydrogen are also used in the metal trades, particularly in shipbuilding, for cutting and welding. There are

Cell room of the electrolytic lead refinery at Trail, B. C. The Consolidated Mining & Smelting Company of Canada also operates a copper refinery and an electrolytic zinc plant at Trail.

eight electrolytic oxygen and hydrogen plants in western states, having a capacity of 122,000 cu. ft. of oxygen per day, and the demand for these gases will increase. Several plants for the hydrogenation of vegetable oils imported from the Orient are contemplated, one of the largest being that of the Vegetable Oil Co. of Los Angeles.

The electrolysis of alkali chlorides for the production of bleaching powder and caustic soda is one of the most important electrochemical industries. Caustic soda is used by the paper pulp industry in large quantities and is one of the most widely useful heavy chemicals. Chlorine compounds, also, have an



Rotary converters at the electrolytic zinc plant at Great Falls, Mont. Each converter has a capacity of 5800-kw. output at 580 v., 10,000 amp. d.c. The a.c. voltage is transformed from 110,000 to 406 volts in one step.

essential place in modern civilization. The Great Western Electrochemical Co. is the only plant on the Pacific Coast producing caustic soda and chlorine compounds. Any increase in the production of these chemicals will come as the result of general industrial growth, since it is essential that a market be found for both the caustic soda and chlorine.

Nitrogen and phosphoric acid are essential elements of plant food, and western agriculturists are beginning to appreciate the advantages, if not the necessity, of fertilization in the production of practically all crops. A very large increase in the demand for fertilizer material is certain. Nitrogen can be produced from the air in electric arc furnaces; whether this process will become important in the West depends upon the cost of power. The only arc nitrogen fixation plant in the United States is operated by the American Nitrogen Products Company at La Grand, Wash.; this company also operates a plant at Lake Buntzen, B. C. Very large quantities of power can be used for nitrogen fixation, if supplied cheaply enough. In Idaho, Utah and other Rocky Mountain states there are large deposits of phosphate rock. An efficient process has been developed for the production of soluble phosphates from the rock by the use of electricity. This is a further possible use for power, and the market is at hand for the product.

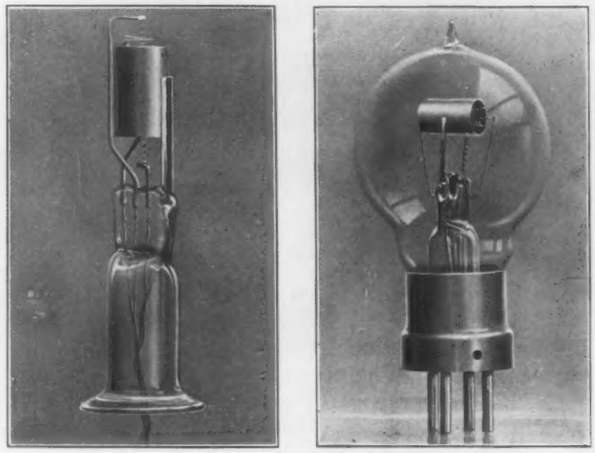
In this brief review of the electrochemical and electrometallurgical industries in the West, it will be noted that many products of these industries, such as abrasives, graphite and aluminum, are not mentioned. Whether any of these can be produced depends upon the demand for the product and the cost of power. A limited market and high power costs are holding these industries back at present. Possibly when a market exists for the products it will be possible to produce power at a cost which will stimulate the development of an electrochemical industry. This is not only desirable, but essential to the growth of the industrial West.

Electric Welding in Radio Apparatus

BY F. A. ANDERSON

(Industry and scientific research have an interdependence which is a fundamental factor in progress. The following article links the art of electric welding and the recent developments in radio work, describing how delicate electric welding operations have helped to perfect radio receiving and transmitting apparatus. The author is an electric welding engineer with the U. S. Shipping Board in San Francisco.—The Editor.)

So rapidly does progress change the mysteries of yesterday into the commonplace accomplishments of today, that the ordinary layman loses sight of the difficulties which the engineers encounter along the pathway to success, and so, as we look back to the beginning of the art in wireless telegraphy, with its attendant doubts and fears, and then remember with what skepticism we viewed the proposal of the wireless telephone, we cannot help but admire the courage of those who have made possible radio telegraphy and telephony, so useful and important in our business of today.



On the left is shown the inside, or mount of an amplifier, and on the right a transmitting tube

The object of this article is to show how electric welding has helped to bring about a measure of success in this art. To do this it will be necessary to describe briefly some of the apparatus on which it is used.

There are two important functions which must be performed in the radio art, namely, amplification and detection. To accomplish these there have been developed what are known as vacuum tubes. These are made in three types—two of which are used in receiving, and one in transmission service.

The manner in which electric welding contributes to the success of these tubes is in joining together the very small metal parts used in their manufacture. The metal is all of very small sectional area, and requires delicate and expert operation; for this reason female help has been found to be the most efficient. The accompanying illustration is from a section of the Moorhead Laboratories, where a group of women is assembling and electric welding the parts for vacuum tubes.

The electric welder for doing this work is not much larger than an ordinary sewing machine, and occupies a table space of about 10 by 12 inches, and is about 12 inches high. One of these machines is shown in an accompanying illustration, with a part of the tube on a jig ready to be welded.

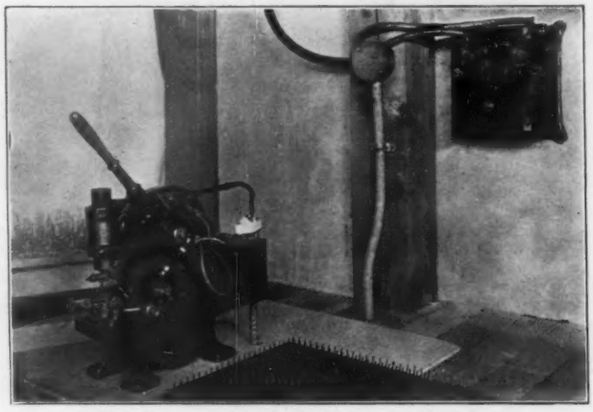
Detector, Amplifier and Transmitting Tube

The more important of the two receiving tubes is the detector, which rectifies and intensifies the high frequency incoming signals into low frequency pulses which are audible as a musical note in the telephone receiver. Within this tube is a tungsten filament surrounded by a nickel helix, and a nickel cylinder. The helix is composed of several turns of spring, nickel wire .02 inch in diameter, which is electric welded to a nickel wire support .03 inch in diameter. So successfully is the weld made that only one support is necessary to hold this helix in place within the cylinder. The cylinder is ¾ of an inch in diameter, ½-inch long, and is made of sheet nickel .007 inch thick. It is supported by a nickel wire .03 inch in diameter, the wire being electrically welded to the cylinder.

The other tube used in receiving is known as the amplifier. Its purpose is to strengthen very weak signals in order that they may become audible.

The two tubes, both detector and amplifier, are very similar in appearance, and the welding operation is also somewhat similar in character, only that the sizes to be welded are of much smaller sectional area; the grid, or helix, being made of wire about .01 of an inch in diameter, while the cylinder is about half an inch long, three-eighths of an inch in diameter and made of sheet nickel .003 inch thick.

These amplifying tubes are also extensively used in wire telephony, and have made possible successful trans-continental communication. Between San Francisco and New York there are about seven points in



Machine for electric welding of vacuum tubes. This machine occupies a table space of about 10 by 12 inches, and is about 12 inches high.

the line where such tubes are used as relays to maintain the sound volume.

The transmitting tube is principally for use in radio telephony, and aids in producing the continuous high frequency currents necessary for transmitting speech and music. Within this tube is a molybdenum helix and cylinder. The helix is one-eighth of an inch in diameter, made of wire .0056 in. in diameter, welded to a nickel wire .015 in. in diameter, which nickel wire is in turn welded to a copper conductor. The cylinder is three-eighths of an inch in diameter and five-eighths of an inch long, and is made of metal .003 inch thick, welded to a nickel angle 3/64 inch by 3/64 inch, .005 in. thick.

Manufacture of Vacuum Tubes

These vacuum tubes are made by two San Francisco manufacturers. Those described in the foregoing paragraphs are the product of the Moorhead Laboratories, while another is made by Lee DeForest, Inc. The DeForest tube is a much larger and more powerful type, and the electric welding in it shows a larger field of accomplishment, for a greater number of different metals are used, all electrically welded to each other.

Within this tube, tungsten is electrically welded to dumet; nickel to tungsten; copper to nickel; molybdenum to nickel; iron to molybdenum, and molybdenum wire to tungsten, and copper to dumet. All of these metals are of very small sectional area, being under 1/16 of an inch in diameter or thickness.

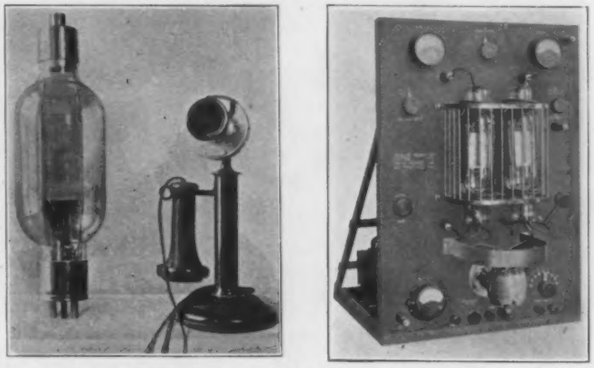
The electric welding is all of the resistance type, and is of the kind known as spot welding. The delicacy of the work may be judged from the fact that the two electrodes and the wires to be welded are within an area of three-sixteenths of an inch in diameter, and this inside a pyrex glass tube.

It is an interesting scientific fact that the vacuum tube is the most sensitive relay ever developed, and works entirely without inertia.

It is an accomplished fact of today that one may take his ordinary house or business telephone, and

A section of the Moorhead Laboratories, showing a group of women assembling and electric welding the parts for vacuum tubes.

by use of the wires as far as Los Angeles, and then by means of radio telephony, communicate with the Catalina Islands. By means of the DeForest station at the California Theater, thousands of people equipped with their own radio receiving sets may enjoy the music from two of the prominent San Francisco theaters, where at stated periods music is played, and by means of radio apparatus sent out



The picture at the left shows the DeForest vacuum tube. At the right is shown the DeForest Oscillion transmitter which employs two of these vacuum tubes.

broadcast into space. Not alone do the people in their homes enjoy this, but ships 1200 miles off shore have reported that they distinctly heard and enjoyed music gathered through the means of the ether waves.

Music and speech stripped of their beauty, and expressed in technical terms, are but sound waves of varying length, intensities and vibrations. Radio telephony gathers these waves by mechanical devices, transposes them into electrical waves, then discharges them into space from whence they are again collected and transposed into electric waves, which mechanically reproduce the sound waves as harmonious music or the familiar speech of a friend.

INCREASE IN MANUFACTURES IN THE WEST

The West is emerging from the mining and agricultural stage of its development. Manufacturing is beginning to play an important part in its commercial activities. Present plans everywhere throughout the West include enlargement of manufacturing facilities. Though this is due largely to the natural evolution in the development of the West, it is being hastened by various changes brought about by the new economic situation, the least of which is not the increase in freight rates.

The coming of many new manufacturing plants will stimulate both mining and agriculture. Throughout the West are many signs of underlying strength in the position of the mineral-mining districts, induced largely by the decreases in commodity prices. For the most part, the work of the Federal Government in the West has been on its metals. Now, with the promised rise of chemical industries and activities in connection with the construction industry, there is need for a more definite knowledge of the non-metals. In fact, the Los Angeles Chamber of Commerce has made a formal request that the Geological Survey undertake a thorough study of the non-metals in the region tributary to that city.

Interior of E. L. Knight & Company's store in Portland. Plenty of bright color, special devices for the display of lamps and fixtures, and various methods of economizing the time of salesmen, are special features of this distinctive electrical retail establishment.

New Ideas in Electrical Retailing

BY H. B. ROGERS

(Maintaining the high standards of electrical merchandising set during the past few years calls for constant exercise of ingenuity, taste and originality on the part of the dealer. The following account of a progressive store in the Northwest is by the Spokane manager for the Pacific States Electric Company, and indicates the trend of electrical retailing in that section. —The Editor.)

There seems to be a challenge in the Northwest that goes something like this: "Here is my new electrical store: equal it if you can." Number 449 Washington Street, Portland, Oregon, the recently opened electrical store of E. L. Knight & Co., is one of the latest challengers. It has a floor space of approximately 7,000 sq. ft. The interior is finished in a warm French gray, with furniture upholstered in a many-colored tapestry to combine with the colorings of the stand lamps and shades. The resulting display is a riot of color, making an electrical store that is different.

The management believes that all merchandise must be displayed, and easily accessible to the prospective customer. For this reason there are four stalls for the displaying of fixtures—bracket and ceiling—each stall being divided by a bank of switches in the four compartments. On the corner post of each stall these switches are mounted, one plate covering the bank. Five fixtures are controlled from this plate, and as a salesman or customer pushes the switch controlling the fixture he admires, he can immediately ascertain its price, the price of each fixture being shown by a card insertion on the plate directly opposite the switch. Each piece of merchandise is marked, and a customer shopping through the store can light any fixture without the necessity of a salesman being constantly present.

Only nationally advertised goods are merchandised in this store. There are four large windows with removable backs, and the trims are tied in with national advertising, the store supplementing them by local newspaper advertising.

E. L. Knight & Co. have eliminated the idea of the overhanging lamp rack in which a customer could find the kind of a lamp he wished, and have evolved a new scheme of selling lamps. Flush with the top of the lamp table is a box divided into compartments, white enameled and covered with plate glass, containing each size and kind of lamp sold. Each lamp is controlled by a pull socket, the chain of which hangs conveniently within reach of the customer or salesman. The white-painted compartments take the glare from the eye and make it possible to see the lamps and get a fairly good idea of the size wanted before lighting it.

At the end of the lamp counter is a window, with a sign over it reading, "Repair Shop." Customers entering this store with any repairing to be done do not bother with the floor salesman, but carry their merchandise to the repair window, and call and pay for it there. This prevents the salesman's time being taken up in looking after repair jobs, and releases him from any duties except selling on the floor.

Every store has a slogan, and the slogan of this store is: "No Order Too Large for Our Capacity Nor Too Small for Our Consideration."

Course in Accounting

The widespread interest shown by contractor-dealers in the standardized accounting system has led Journal of Electricity and Western Industry to arrange for an authoritative series of articles on this important subject. These will be written by Henry R. Hatfield, head of the Department of Commerce of the University of California, the first article to appear in the issue of March 1st.

Electricity in the Machine Shop

BY H. L. TODD

(The importance of the machine shop in the operation of the modern industrial plant has led to a widespread introduction of efficient electrical equipment for the machine shop. In the following article the electrical engineer for the Union Tool Company discusses the proper equipment, with special reference to adequate and scientific illumination.—The Editor.)

Electricity is one of the most important factors in the modern machine shop—it means greater economy, more production, and a better finished product. The first thought in bringing electrical power into a machine shop is to have it properly distributed. If the shop is less than 1000 ft. in length, the proper voltage for alternating current motors is 440, and for direct current motors, 250 volts. Panel boards should be located at least every 250 feet on either side of the shop—this gives a feasible method for distribution. Every machine in the shop, if possible, should be driven by an individual motor. The individual motor drive has many advantages over the line shaft drive, such as economy of power (since motor runs only when machine is being operated), one operator and one machine idle when motor trouble occurs, no danger from belt shifters and belts, no "up keeping" of line shaft and belts, and the absence of vibration in building which, at night, causes flickering of lights, and, again, the advantages of placing a machine at any angle in the shop. All handles for the electrical controlling apparatus should be made a part of the machine to be operated and placed in the most convenient position possible. Each motor should be equipped with a no-voltage release as well as an overload relay, and a release button should be installed to cut off the power instantly in case of an emergency.

Choice of Equipment

Whether to use a direct current motor or an alternating current motor is often a very important question. If the machine itself has sufficient changes of speed to do the class of work desired, always use an alternating current motor as it is more efficient and will cause less trouble. On the other hand, if frequent starting and stopping are necessary, and a great variety of speeds desired, the direct current motor with 400 to 1200 r.p.m. should be installed.

All circuits and switches used in connection with its motor should be marked legibly and intelligibly with the same number as the motor, so that no time is lost in locating trouble. The location of all switches, motors and starters, as well as a list of necessary repair parts, should be posted in the electrical department, in order to enable the electricians going out on a trouble job to have the motor running as soon as possible.

Great care should be exercised in purchasing proper electrical apparatus. Select good apparatus, and standardize. Regular inspection of apparatus should be made, and wearing parts renewed regularly, since trouble is apparent before the trouble becomes serious. Frequent use of portable testing meters should play an important part in preventing motor troubles, and in many cases it is found that the proper motor is not being used. Complete records of all electrical apparatus should be kept up to date. A history of its service will prevent the repurchase of unsuitable apparatus.

Always avoid temporary wiring—only in emergency should it be permitted. All wiring should be in conduit and placed where it can not be injured by vibration, water and steam lines.

Lighting the Machine Shop

The conservation of eyesight is often of so much economic importance that six states have adopted lighting codes, and several others have tentative codes. All these have one motive—the protection of the workmen, for the authorities realize that most

The main machine shop in the plant of the Union Tool Company's plant at Torrance, California. Notice the clearness of detail and the absence of glare or sharp shadows.

accidents in the machine shop are caused by dim illumination, glare (both direct and reflected), long sharp shadows, and high contrasts. The following are requirements for a modern efficient lighting system:

1. Sufficient intensity of proper quality on the working plane (horizontal and vertical).
2. Light properly diffused.
3. A system which is simple, reliable, easy of maintenance and low in operating cost.
4. A modern intensity of light over the useful area, eliminating shadows and objectionable contrasts.
5. Absence of both direct and reflected glare.

Intensity and Proper Diffusion —

An obvious requirement for satisfactory illumination is that the quantity of light on the working plane be sufficient. In designing a lighting system careful attention must be given to the average reflecting power of machine, tools and material, and on fine machine work in which accurate measurements are made and tools must be set with great precision, a very intense illumination is required.

In order to eliminate sharp, harsh shadows and permit the pupil of the eye to work naturally the

light must be properly diffused. It is very difficult to read when the reading matter is held in the sun, so it is true that a large number of small lamps are preferable to a few large ones.

Avoiding Contrasts —

In order not to have too high a contrast of intensity between the work, the floor, the columns and the walls, it is absolutely necessary for some light to fall on all of them. The lower portion of the walls should be a color which is restful to the eyes, preferably a factory green or a rather dark shade of yellow.

In addition to the supply of proper light throughout the shop, a well designed system of illumination should provide for light on adjacent objects and on the shafting and belting, if any, as well as on the walls and ceiling—a system which is simple, reliable, easy of maintenance and low in operating cost.

Proper voltage is a very important factor, as well as a lamp of the proper voltage. It is always good practice to have your transformers, if using alternating current, as near the lamps as possible, eliminating all chances of voltage drop. The installation should be such that lamp renewals can easily be made and reflectors cleaned frequently, since large losses of light result from the accumulation of dust and dirt. Always control as few lamps as possible in each group, so that lamps not needed may be turned off.

Glare —

Glare is sometimes described as light "out of place." Absence of glare is considered the most essential qualification in good lighting. The purpose is not to have a source of light to look at, but to illuminate the objects in the shop so that they can be seen distinctly and with comfort to the eye. Glare is dangerous, for it is positive in its harm. It destroys good eyesight — at first momentarily, and then permanently. Eye strain and fatigue cause headaches, nervousness and inefficiency. The result is low production, spoiled material, wasted time, higher cost per unit of output and more accidents.

A good industrial lighting system will demonstrate its own success in increased production, reduction of operating expenses and improvement in the quality of the product. All of these result in increased dividends, a convincing argument for the necessity of adequate illumination facilities in industrial plants.

Problem Course in Electricity

BY H. H. BLISS

(Do you know just why one generator generates at a higher voltage than another? The following article, the fourteenth of a series, takes up the question of structure and efficiency in generators and various generating problems that may help you increase the efficiency of your shop. The author is on the staff of the Riverside Junior College, Riverside, Cal.—The Editor.)

ELECTRIC GENERATORS

Voltage Generated. — From experiments that show that the voltage of a generator can be increased by running it faster, by putting more wires on the armature, or by strengthening its magnets, we may derive our conception of a line of force as a unit of magnetic flux in relation to the voltage it induces in a wire cutting across it with a definite speed. Thence comes the fundamental definition that the average voltage induced in a single inductor by magnetic action equals the number of lines cutting it per second ÷ 100,000,000.

If the N pole of a magnet, from which stream out 15,000 lines of force, is thrust in 1/20 of a second through a coil of 400 turns of wire, what voltage will be induced in the coil? The lines cut the wire at the

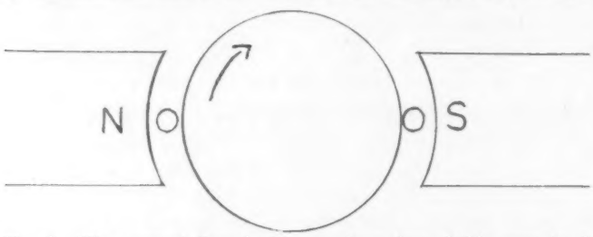


Fig. A.—When current flows in the armature wires of this generator it makes the core an electromagnet whose attractions and repulsions for the stationary poles tend to stop the machine.

rate of 15,000 × 20 = 300,000 per second, and hence would induce in a ring or in a single turn of the wire a voltage of 300,000/100,000,000 = .003 volt. (It should be clearly understood that it is correct to consider this a cutting of the conductor by 300,000 lines per second, just as an automobile can go "20 miles per hour" without traveling more than a minute; the induced voltage is just as high as if there were actually 300,000 lines of force, but in this case it lasts only for 1/20 of a second.) Each turn having .003 volt and there being 400 in series, the total for the coil = 400 × .003 = **1.2 volts.**

What is the average voltage induced in a single coil between two magnet poles (Fig. A) if the flux issuing from N = 250,000 lines and the coil revolves (on an axis perpendicular to the paper) at 40 revolutions per second? The straight wire at the left cuts across 250,000 lines (from bottom to top) in 1/80 second, hence the volts in it = 250,000 × 80/100,000,000 = .2. The other side of the loop, being in series, adds its voltage, giving a total of **.4 volts.** This is the average pressure induced, for of course the voltage is sometimes lower and sometimes higher than this figure, changing as the wires move from the denser to the weaker portions of the magnetic field.

This example should make clear that each wire on the surface of an armature is counted as one "inductor" in the general generator formula:

Volts = poles passed per sec. × flux per pole × inductors in series ÷ 100,000,000.

The derivation of the formula from the fundamental relation is, of course, simple. Checking it in the example above, we get: volts = 2 × 40 × 250,000 × 2/ 100,000,000 = .4.

It should be noted that this discussion deals strictly with the "induced voltage," and that the actual voltmeter reading at the generator terminals is often somewhat lower. The cause and amount of this drop in the generator will be discussed in a later chapter.

Load on a Generator.—It is an instructive experiment to run by hand a small magneto, such as those used in ringing telephone bells, and observe the effect of connecting to it a small load, such as a 30-volt lamp. The machine runs easily, while the circuit is open, before the lamp is connected, but it is appreciably harder to operate as soon as it "carries load." Similarly the valves of a steam turbine must admit more steam whenever more current flows from the generator it drives; in case of a short circuit the sudden great increase in steam flow so changes the sound of the machine that the operator is instantly aroused to the situation.

Let the simple armature of Fig. A be revolving "clockwise" (turning in the same direction as the hands of a clock). If the current starts to flow **"in"** (into the paper) along the conductor at the left and "out" along the other, the whole armature tends to become an electromagnet with a S pole at the top and a N pole below. The attractions and repulsions of these poles for the field magnets, becoming greater as the current increases, explain the difficulty in moving the armature when current flows. By the time the wires are brought to positions 90° from those shown, their current dies out, for they are no longer cutting lines of force. As they move farther, current starts again in the opposite direction, thus again producing magnetic forces which oppose the driving torque.

If the induced currents flowed otherwise than as indicated above, the magnetic forces would obviously make it easier instead of harder to drive a generator as its current increased. Thus we establish the truth of the rule for the direction of induced currents (or, better, of induced e.m.f., since the voltage is directed the same way whether the current is allowed to flow or not):

Observe which way the rotating part of the machine is turning, whether it be the field or the armature. It is then possible to select a station at one end of the shaft or the other from which the machine is seen to rotate **clockwise.** Then in the armature wires near each N pole of the field the e.m.f. is directed **away** from the observer, and in those near the S poles, toward the observer. As a memory scheme, note that clockwise is the "natural" or "right-handed" way of rotation, and connect the idea of **north** with something getting **away** from one —as pliers slip from chilled fingers.

Stress is laid on this rule as it can be worked to determine from a drawing any one of the three factors, rotation, polarity or direction of e.m.f., when the other two are known. It can be made to apply also to motor problems, as will be shown later. Some will prefer, however, to use Fleming's famous right and left hand rules, which can be found in most books on electricity.

Lentz's Law.—If induced currents ran in such a direction as to produce magnetic forces helpful to the driving engine, we might have a machine giving out more energy than it absorbed—or with over 100% efficiency. Our rule for the direction of these currents is, then, in accordance with the fundamental engineering law that energy is obtained only at the expense of an equal or greater amount of other energy.

Lenz's Law follows from that law: "Induced currents, under any circumstances, always flow in such a direction as to set up magnetic forces opposing the magnetic action that causes them." For instance, if a N pole is brought down to a coil, the current induced makes the coil an electromagnet with N pole upward, repelling the moving magnet. The direction of the current around the coil is then determined from the rule for polarity of electromagnets.

Generator Magnets.—The fact that electromagnets can be made much stronger than permanent magnets, and the possibility of varying the flux by means of rheostats, are the reasons why electromagnets are used in all generators except small magnetos. Direct current machines generally have on each pole one coil of the "shunt field winding," the coils all being in series with each other and the field switch and rheostat. This circuit is connected between the brushes, being in multiple with the load on the machine. The series coils of the "compound winding" are put upon the same pole cores, often at the outer end, and connected in series with each other and the load.

In many generators the series coils have extra ampere-turns so that the voltage at the machine rises considerably as the current increases. The line drop brings it down to the "no load" value at the lamps and motors if there is much resistance in the line, and so the machine works satisfactorily for a distant concentrated load.

The excitation of a 4-pole alternator is maintained by the arrangement shown in Fig. B. The rheostat, **r**, governs the voltage of the exciter, and

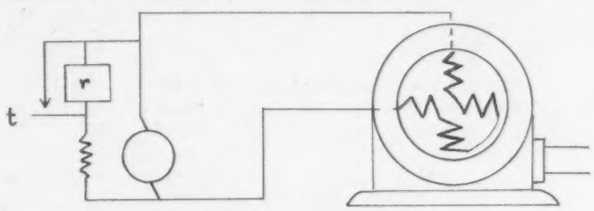


Fig. B.—Four pole alternator and exciter, governed by an automatic voltage regulator.

this in turn determines the current in the alternator field coils and hence the voltage generated by that machine. Automatic regulation of the line voltage is accomplished in many installations by the use of a device to short circuit the exciter rheostat at **t** when the alternating e.m.f. drops. The contact opens again after the pressure rises. Thus by clicking open and shut several times per second the regulator keeps the average voltage at the value desired.

Solutions of Last Wiring Problems

150. First circuit constant = 45,000. Select wire No. 8 from table No. 3. Second constant = 16,200. Wire No. 12. These wires are safe, according to table No. 2.

151. Circuit constant = 40,000. In table No. 3 we find that this lies between the figures for .4 and .6 volt drop with No. 3 wire. Answer: over .5 volt, as 40,000 is closer to the figure for .6 volt.

152. 16.4 + 7.8 = 24.2 lbs.

153. From table No. 1, watts = 480. Circuit constant = 62,400. Select No. 8 wire from the figure 72,000 in last column of table No. 3. Weight = 16.4 + 4.9 = 21.3 lbs.

154. Calling the first circuit (1), its constant = 66 × 60 = 39,600; constant of circuit (2) = 4800.

Circuit	Constant	Transm. Dist.	1st Scheme No.	1st Scheme Drop	1st Scheme Wt.	2nd Scheme No.	2nd Scheme Drop	2nd Scheme Wt.	3rd Scheme No.	3rd Scheme Drop	3rd Scheme Wt.
(1)	39,600	60	8	1.6	9	6	1.1	13	5	.8	16
(2)	4,800	80	10	.3	8	14	.8	4	14	.8	4
					17			17			20

The first selection is to be preferred, as it gives as small a weight as any, without calling for the small wire (No. 14). All the wires are safe for the loads mentioned.

155. Section (1) carries 630 watts 100 ft.; constant = 63,000. Section (2) has constant = 210 × 40 = 8,400; section (3) has constant = 15,300.

Circuit	Constant	Transm. Dist.	1st Scheme No.	1st Scheme Drop	1st Scheme Wt.	2nd Scheme No.	2nd Scheme Drop	2nd Scheme Wt.	3rd Scheme No.	3rd Scheme Drop	3rd Scheme Wt.
(1)	63,000	100	3	.8	45.6	5	1.3	30.8	4	1.1	38.0
(2)	8,400	40	6	.2	10.4	6	.2	10.4	5	.2	12.3
(3)	15,300	170	8	.7	27.9	6	.4	44.2	8	.7	27.9
					83.9			85.4			78.2

Evidently the third scheme is most economical. Wires are safe.

156.

Circuit	Constant	Transm. Dist.	1st Scheme No.	1st Scheme Drop	1st Scheme Wt.	2nd Scheme No.	2nd Scheme Drop	2nd Scheme Wt.	3rd Scheme No.	3rd Scheme Drop	3rd Scheme Wt.
(1)	128,000	160	2	1.3	83	2	1.3	83	3	1.7	64
(2)	10,500	30	5	.2	8	6	.3	7	2	.1	16
(3)	9,000	50	8	.4	8	8	.4	8	5	.2	13
(4)	6,800	40	14	1.2	2	14	1.2	2	14	1.2	2
					101			100			95

The last scheme is cheapest. However, it would be preferable to use No. 10 or 12 wire instead of No. 14 for section (4), since an outdoor circuit of such small wire is liable to sag and break.

Generator Problems

157. The turbine in the Wise power plant has 87% efficiency and drives a generator of 96% efficiency which delivers to the line 12,000 kw. How many hydraulic horsepower are delivered to the turbine?

158. The shunt field coils of a 6-pole direct current generator have 17 ohms each. What is the resistance in the rheostat when the exciting current is 2 amperes with a brush voltage of 250?

159. An 8-pole generator has 3,000,000 lines per pole and runs at 800 r.p.m. How many poles are passed per second by one armature inductor and what is the voltage induced in it?

160. What is the average voltage induced in a coil of 300 turns into which a magnet with 500,000 lines of force is thrust in 1/10 second?

161. Upon each pole of a bipolar d.c. generator is wound a shunt coil of 1200 turns of number 26 wire. Find the resistance of the shunt field, taking the average length of turn as 18 inches. The voltage of this machine being 120, what is the resistance in the rheostat when the shunt ampere-turns equal 1800?

162. Find the r.p.m. of the 4-pole alternator of Fig. B if it produces "50 cycle" current (100 reversals of direction per second).

163. Find the flux per pole crossing the air gap of a 4-pole alternator running at 1800 r.p.m. and generating an average voltage of 2550, there being 144 inductors in series in the armature.

164. Each pole in Problem 163 is of wrought iron, rectangular in cross section, 8 in. by 23 in. and 20 in. long (including yoke). The air gaps are 25 in. by 30 in. and ¼ in. long, and the flux passes for 36 in. through the sheet steel (2¼ in. by 30 in. in cross section) of the armature from one pole to the next. Assuming no leakage, find the ampere-turns that must be put upon one pole to force the flux through the core, across one air gap, and half way to the next pole through the armature. Note that the flux divides as it leaves the pole, half going each way in the armature, so that the density in the sheet steel is ½ the flux/area. (Turn to page 482 of the Journal of Electricity for November 15, 1920, for data on the magnetic characteristics of iron and steel.)

165. A bipolar direct current generator with 200 inductors in series on the armature must produce 120 volts when running at 2400 r.p.m. Find flux per pole and average flux density in armature, air gap, pole cores and yoke, the dimensions being: armature, effective diameter 3 in., length 2¾ in.; air gap, 2¾ by 4½; poles, 3.7 in. diameter; yoke 2 in. by 6 in. Take the leakage coefficient as 1.3.

166. In the previous problem the armature is of sheet steel and the lines travel an average of 4 in. in it; each air gap is .02 in. long; the poles are of cast steel 7 in. long, and the yoke (of cast steel) is 8½ in. long (between centers of poles). Find the total ampere-turns necessary.

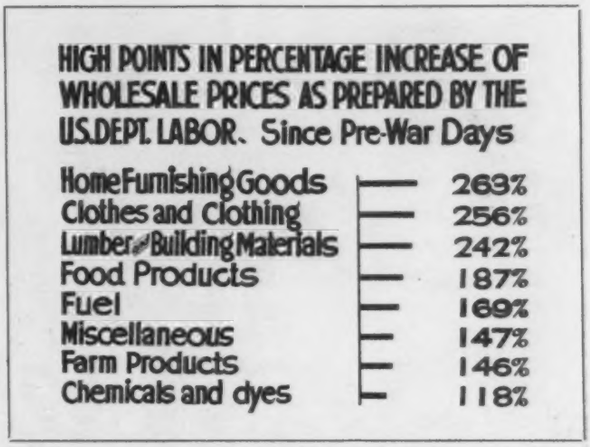
THE WORLD'S FUEL SUPPLY

The world needs more power. For present and future sources of energy we have to look to flowing water and the mineral fuels. Only about one-twentieth of the potential power of the world's rivers has been utilized, and over half of this in North America, with Europe credited with one-third and the rest divided between Asia, South America, Oceanica, and Africa, in the order named. In its potential resources, however, Africa ranks not last but first; it has over 40 per cent of the world's supply of water power and is followed in turn by Asia, North America, Europe and Oceanica. In the division of coal resources among the continents, at least of the better grades of coal, similar inequalities are seen: North America has more than half, Asia about a quarter, Europe a sixth, and the rest is divided between Oceanica, Africa and South America, in the order named.

The United States Geological Survey's estimate of the petroleum resources of the world shows that the distribution, while unevenly balanced among nations, is evenly balanced between the eastern and the western hemispheres.

AVERAGE PERCENTAGE INCREASE IN PRICES OF RAW MATERIALS SUCH AS METALS, OILS, LEATHER GRAINS ETC.
FROM MAY 1914 TO MAY 1920.
Bradstreet's Index 96 Commodities
156%
Dunn's Index 200 Commodities
117%

The high cost of living is still with us, as indicated by comparisons of present costs of raw materials with prices in 1914. It is not to be expected that even at the lowest level prices will return to pre-war figures.


HIGH POINTS IN PERCENTAGE INCREASE OF WHOLESALE PRICES AS PREPARED BY THE U.S. DEPT. LABOR. Since Pre-War Days
Home Furnishing Goods 269%
Clothes and Clothing 256%
Lumber & Building Materials 242%
Food Products 187%
Fuel 169%
Miscellaneous 147%
Farm Products 146%
Chemicals and dyes 118%

Wholesale prices show an even higher level than raw materials, partly because the higher prices of raw materials purchased earlier are still in effect and partly because labor costs have not been materially reduced.

No Profiteering in Electric Manufactures

BY H. L. GARBUTT

(An extract from a paper presented at convention of the Electric Supply Jobbers' Association of the Pacific Coast at Del Monte, January 26-28, 1921. The author is manager of the Supply Division of the Westinghouse Electric & Manufacturing Company at San Francisco.—The Editor.)

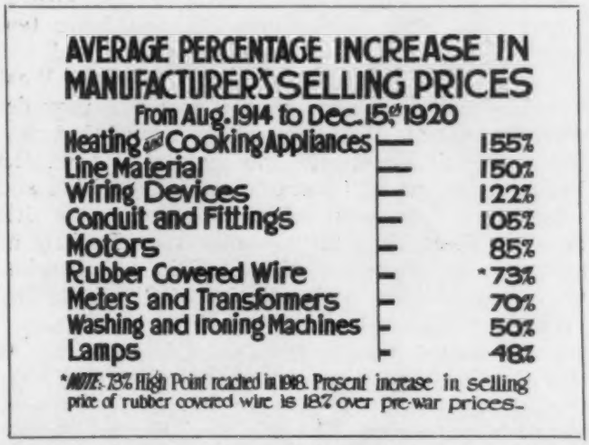
A study of the financial reviews shows a marked increase in price applying to raw materials such as metals, oils, grains, leather, etc., which products have not been affected by labor to as great an extent as manufactured articles such as electrical apparatus. These percentages have been reduced somewhat since May 1920, on account of the large stocks on hand throughout the country in excess of the demand—a situation which necessitated liquidation.

Up to the present time electrical supplies have not been produced in sufficient quantities to supply the demand and there is no indication that the manufacturers of this product will get caught up on their back orders for some considerable time, therefore we need not look for prices on this product to be reduced to any great extent on account of lack of demand.

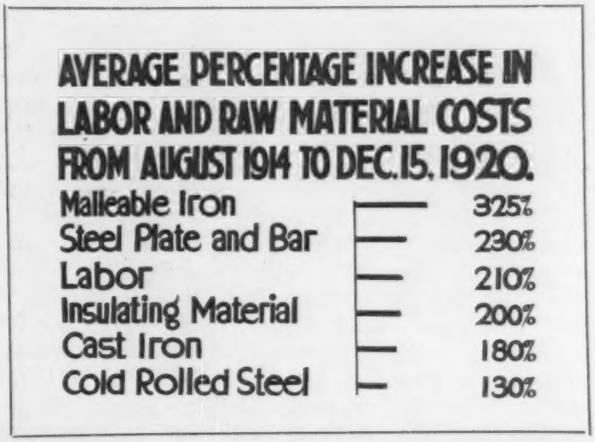
Even if manufacturing costs are theoretically reduced a small amount, which is probable, due to material reductions, and if at the same time the demand for electrical products also decreases so that the manufacturing sections are not kept full, yet the increase in direct costs which will automatically result due to the falling off of production, will counteract the decrease.

The relation of labor to material in electrical manufactured products is such that a considerable amount of reduction in material alone would be necessary before there will be an appreciable effect in the cost of the manufactured apparatus. For instance, a reduction of 30% in material would only average about 10% reduction in total costs and a corresponding reduction in the cost to the jobber.

It is reasonable to assume in regard to manufactured electrical products that there must be a combination of reduced cost of materials, reduced cost of labor, and a continued normal demand for the product before there can be any reduction in factory costs with a corresponding reduction in selling prices. Therefore it is the opinion of the speaker and his coworkers who assisted him in preparing this paper that there should be no let-up in buying with the anticipation of greatly reduced costs as from present indications any future price reductions in the electrical supply line will be moderate as compared with prices on commodities that are termed necessities.


AVERAGE PERCENTAGE INCREASE IN MANUFACTURER'S SELLING PRICES
From Aug. 1914 to Dec. 15th 1920
Heating & Cooking Appliances 155%
Line Material 150%
Wiring Devices 122%
Conduit and Fittings 105%
Motors 85%
Rubber Covered Wire *73%
Meters and Transformers 70%
Washing and Ironing Machines 50%
Lamps 48%
*NOTE. 73% High Point reached in 1918. Present increase in selling price of rubber covered wire is 18% over pre-war prices.

Present manufacturers' prices of electric appliances and apparatus are extremely low compared to the level of raw material and labor costs and cannot be expected to drop appreciably at an early date.


AVERAGE PERCENTAGE INCREASE IN LABOR AND RAW MATERIAL COSTS FROM AUGUST 1914 TO DEC. 15, 1920.
Malleable Iron 325%
Steel Plate and Bar 230%
Labor 210%
Insulating Material 200%
Cast Iron 180%
Cold Rolled Steel 130%

Costs of all raw materials which go into electrical manufactures are still very high. Copper is the one exception, and this is more than offset by the continued increase in the price of labor.

The business district of San Francisco where the Journal of Electricity and Western Industry has been published since 1887.

The Thirty-fifth Year of Service to the West

For every additional home built in a Western community, for every additional person employed in Western industry, for every four acres of land brought under irrigation by electric pumping, it has been figured that an additional kilowatt in capacity must be added to the power plants of the West. This close relationship of electricity with agriculture and industry in the country west of the Rocky Mountains is a natural consequence of the particular qualities of soil, climate and physical characteristics of this region which have led to a high development along all lines of electric power usage.

Although coal and oil occur in considerable quantities in several of the Western States, their use in industry has from the beginning been recognized as a permanent drain upon limited resources. In consequence, this mechanical phase which has been so essential a part of Western development, has been naturally tied up with power from the glaciers and streams of the Western mountain ranges and, further, partly due to the magnitude of the undertakings thus involved, has largely been associated with power company service rather than with isolated plants and individual developments.

So close has been this connection of power with the growth of this region, that the story of electricity in the West may be said to be the story of the West itself. It is this story which the Journal of Electricity and Western Industry has told throughout its thirty-five years of service to the West. In 1887 was founded in San Francisco the Pacific Lumberman Contractor and Electrician, the electrical department of which was devoted to the upbuilding of the comparatively new electrical industry of the Pacific Coast under the editorial guidance of George P. Low. This was the beginning of what is now the Journal of Electricity and Western Industry. It found the West already an extensive user of electricity and the possessor of several world's records in power development.

operation the first hydroelectric plant in America, tral station had been started in San Francisco by Geo. H. Roe. A little later in 1885, the Aspen Electric Company of Aspen, Colorado, had put into operation the first hydroelectric plant in America, destined to furnish power and light for the mines of Roaring Fork. These were world records, the next recorded central station being established in England late in 1880 and New York waiting for the privilege of electric lights until 1882. Western development had followed largely along these lines of central stations for city lighting and occasional individual plants in the mountains for mine service. Long distance transmission was already a matter of interest in the West and we find editorial mention of a record generating plant located at a distance of 500 yards from the market for power and later of the remarkable transmission of current at 3,000 volts for a mile and a half. Four years later the new paper was to record the startling accomplishment of the San Antonio Light and Power Company at Pomona, California, who were transmitting a current of 10,000 volts for 28 miles. There followed a succession of record-breaking feats — ever larger generating units, higher heads, higher tension transmission and longer distances covered.

By 1895, the electrical interests of the West were so well established that it was felt they deserved a paper of their own and in July of that year the electrical department was separated from the Pacific Lumberman, Contractor and Electrician and established as an independent paper under the title of "The Electrical Journal" with Geo. P. Low as publisher and co-editor with Dr. F. A. C. Perrine, the noted engineer and scientist of Stanford University.

A monthly magazine was established just at this time by the Westinghouse Electric and Mfg. Co., however, and some chance decreed that it also should be christened "The Electrical Journal", a confusion of titles which it was felt might result in

James H. McGraw, president McGraw-Hill Company, Inc., of New York, and chairman of the board of directors of the California corporation recently formed to handle the affairs of the Western office. Mr. McGraw's broad vision of service has been the inspiration back of the development of the McGraw-Hill publications.

Robert Sibley, president McGraw-Hill Company of California and editor Journal of Electricity and Western Industry since 1917. Formerly professor of mechanical engineering, University of California, and of electrical engineering, University of Montana. Member A. S. M. E. and Fellow A. I. E. E.

H. A. Lewis, vice-president and member of the board of directors of the McGraw-Hill Company of California. Also advertising director Electrical World and Electrical Merchandising, with headquarters in New York. Supervising Eastern business affairs of Journal of Electricity and Western Industry.

H. W. L. Gardiner, vice-president McGraw-Hill Company of California and business manager Journal of Electricity and Western Industry. Also Pacific Coast business manager for McGraw-Hill Company of New York and directly responsible for all Western advertising of the McGraw-Hill publications.

conflict. In consequence, the San Francisco paper withdrew its claim to the field and in September, 1895, for the first time appeared as "The Journal of Electricity". The paper was a monthly publication and devoted, as its subtitle explained, to "the industrial applications of electricity, gas and power". Among its early advertisers which still are to be found on its pages were numbered John A. Roebling & Sons Co. and the Pelton Water Wheel Company. An article by W. W. Hanscom appeared in the first issue. A little later we find references to E. C. Jones and to John A. Britton, who at that time was treasurer of the Pacific Coast Gas Association. M. A. deLew is reported as giving a series of lectures before the San Francisco Council of the National Convention of Stationary Engineers, and Dr. Addison, who at that time was already manager of the Pacific Coast office of the General Electrical Co., appears as having returned to the Coast from a trip East.

Even at this early date we find the Journal of Electricity championing the electrical interests of the West, and playing an important part in securing the appointment of a Pacific Coast secretary of the A. I. E. E. who should foster engineering activities in this region.

In April, 1906, the Journal of Electricity suffered a complete destruction of its records and plant through the earthquake and fire, as did so many of the business houses of San Francisco. With undaunted spirit, however, the next issue of the paper appeared with only a slight delay and with the announcement that the magazine would hereafter be conducted as a weekly under the title "Journal of Electricity, Power and Gas." E. B. Strong, veteran publisher of San Francisco, directed the editorial and business destinies of the paper at this time, being joined in 1907 by A. H. Halloran, under whose managing editorship the paper was familiar to the electrical industry of the West for many years. Robert Sibley joined the staff of the paper as early as 1911, taking over its editorial direction in 1917, at which time the magazine assumed its present form of a semi-monthly, taking again its old title of "Journal of Electricity".

Within the past four years changes have been rapid. In September, 1919, the Journal of Electricity joined the ranks of the McGraw-Hill Company, making the eleventh in the family of technical magazines published by that company and the only one of the group which is published on the Pacific Coast. In order to bring McGraw-Hill service closer to the West, the McGraw-Hill Company of California has been incorporated under the date of Feb. 1, 1921, and from this time will handle all matters of the Western office. James H. McGraw

Emmet N. Britton, managing editor Journal of Electricity and Western Industry. Graduate University of California. Mr. Britton has executive supervision of the editorial work directly under Mr. Sibley. Associate member A. I. E. E.

Clotilde Grunsky, associate editor Journal of Electricity and Western Industry. Graduate University of California. Special writer and general assistant in the direction and planning of editorial work. Associate member A. I. E. E.

Doris E. Estcourt, assistant editor Journal of Electricity and Western Industry. Graduate Stanford University. Special writer and copy editor in charge of the preparation and planning of general copy and special department work.

Norman S. Gallison, news editor Journal of Electricity and Western Industry. Graduate University of California. Mr. Gallison will have charge of the development of the extended news service which will be a feature of the enlarged paper.

N. A. Bowers, a director of the McGraw-Hill Company of California, Pacific Coast editor of Engineering News-Record, Power, Electric Railway Journal, American Machinist and Ingenieria Internacional, and friend and counselor to Journal of Electricity and Western Industry.

G. E. Armstrong, Pacific Coast editor Electrical World. Journal of Electricity and Western Industry and Electric World have been closely associated in their service to the West and Mr. Armstrong has been an important contributor to these pages.

L. W. Chapman, Pacific Coast editor Chemical and Metallurgical Engineering. Mr. Chapman stands ready to give the Journal of Electricity and Western Industry the services of a specialist in the field of industrial development along chemical and electrochemical lines.

A. H. Halloran, Pacific Coast representative McGraw-Hill Book Company. Not only is the book service an important branch of the work of the Western office, but Mr. Halloran also maintains his interest in the editorial work of Journal of Electricity and Western Industry.

Lois H. Codd, assistant news editor Journal of Electricity and Western Industry. Graduate Mills College.

is chairman of the board of directors of the new organization, Robert Sibley of San Francisco is president, H. A. Lewis of New York City, vice-president in charge of Eastern sales development, H. W. L. Gardiner of San Francisco, vice-president and business manager, and Curtis Lindsay of San Francsico, secretary-treasurer. The Journal of Electricity and Western Industry thus has all the advantages of the backing of the great Eastern company, which is the largest technical publishing house in the world, but with a truly Western organization of its own—a journal of the West for the West, edited and managed by those whose interests are indissolubly linked with the past, present and future of the empire West of the Rocky Mountains.

With this issue the name of the paper is changed to "Journal of Electricity and Western Industry." This is in line with the service to Western upbuilding and a recognition of the interdependence of these two factors in Western development which has been an essential element in the policy of the paper since its beginning. The future of Western industry lies in the development of the power resources of the West—as, of course, reciprocally, the future of the electrical industry is dependent upon Western development as a whole. It is to the future of this great region West of the Rocky Mountains in all its aspects that the Journal of Electricity and Western Industry is dedicated.

In rendering this service, the Journal of Electricity and Western Industry employs a staff of

Ellen E. Trewick, bookkeeper and cashier McGraw-Hill Company of California.

Mrs. E. R. Galloway, make-up editor and proof reader Journal of Electricity and Western Industry.

C. A. Osier, correspondent Seattle district, Journal of Electricity and Western Industry. Daily Journal of Commerce, Seattle.

W. C. Heston, correspondent Portland district, Journal of Electricity and Western Industry. Industrial engineer Portland Railway, Light & Power Co.

M. L. Cummings, Jr., correspondent Intermountain district, Journal of Electricity and Western Industry. Assistant manager commercial department, Utah Power & Light Co.

R. E. Smith, correspondent Los Angeles district, Journal of Electricity and Western Industry. Chief clerk, with the Southern California Edison Company.

H. L. Melvin, correspondent Spokane district, Journal of Electricity and Western Industry. Electrical engineer Washington Water Power Company.

Curtis M. Lindsay, secretary-treasurer of the McGraw-Hill Company of California, and in charge of promotion sales development of the Journal of Electricity and Western Industry.

R. C. Smith, advertising manager Journal of Electricity and Western Industry, with personal supervision of advertising work in the Pacific Coast office.

J. E. Johnston, New York representative Journal of Electricity and Western Industry, in charge of advertising sales for New York and the Eastern district.

Albert Hauptli, Chicago representative Journal of Electricity and Western Industry, in charge of advertising sales for Chicago and the Middle West.

Chas. H. Tallant, office manager and director of service department, Journal of Electricity and Western Industry.

Ruth M. Foster, circulation manager in charge of promotional division work, Journal of Electricity and Western Industry.

seven editorial writers in the San Francisco office with a total of 42 paid workers in all departments. Constant touch is maintained with conditions in the field and in addition to a staff of correspondents in each of the major cities of the West, the editors themselves keep a personal contact with progress in all parts of the region, making frequent trips over the territory and taking an active part in the vital activities of this section. Among the writers who contribute to the pages of the Journal of Electricity and Western Industry are numbered the leaders in every branch of Western industry.

The service of the advertising department is measured by the scope of the paper's editorial pages. The Journal of Electricity and Western Industry tells the story of Western development, it meets the technical and personal problems of industry from the Western standpoint, it has fought shoulder to shoulder along side of the leaders of thought in this region in originating and furthering all movements in the line of progress. It was, for instance, instrumental in forming the organization which is now the Pacific Coast Section N. E. L. A., it had a part in the inauguration of the California Railroad Commission, one of the first of such regulatory bodies and one which has served as a model for similar forward legislation elsewhere. It may fairly lay claim to a decisive role in the formulating of public opinion which led to the establishment of the California Electrical Cooperative Campaign and the later Western movements which followed along these broad lines of cooperative helpfulness. The Journal of Electricity and Western Industry has, indeed, made personal contribution through the services of

E. A. Skuse, assistant in the advertising department in charge of make-up, Journal of Electricity and Western Industry.

Esther J. Helfrich, secretary to business manager, Journal of Electricity and Western Industry.

Louis I. Quinn, field representative circulation department, Journal of Electricity and Western Industry.

L. W. Coe, field representative circulation department, Journal of Electricity and Western Industry.

R. L. Emrick, field representative circulation department, Journal of Electricity and Western Industry.

C. K. Nelson, field representative circulation department, Journal of Electricity and Western Industry.

Guy T. Bowman, superintendent, mechanical department

C. R. Little, assistant superintendent, mechanical department

E. R. Galloway, operator mechanical department

D. J. Gallick, Jr., compositor mechanical department

Edward Gallick, apprentice mechanical department

members of its staff as well as through its columns, to practically all phases of Western progress and today is known as friend, as well as for its impersonal service, to the industry of the West.

This is a unique position from an advertising standpoint offering a group of readers of selected quality. An analysis of the subscribers shows the breadth and strength of this distribution.

Lighting and Power Companies	38%
Industrial Plants	15%
Electrical Contractors and Dealers	15%
Electrical Jobbers	5%
Electric Railways	6%
Independent Engineers	3%
Telephone and Telegraph Companies	1%
Libraries, etc.	17%

The advertising department is prepared through its service division to give expert assistance to advertisers in the preparing of copy and the planning of advertising campaigns to meet Western needs, with the result that the advertising pages may truly be said to supplement the editorial pages in interest and service to readers. It is stating a well known fact to say that the Journal of Electricity and Western Industry reaches and influences over ninety per cent of the purchasing power of the electrical industry of the West today and is fast broadening its influence along the lines of general industry.

The Circulation Department is divided into two branches for the securing and maintaining of Journal of Electricity and Western Industry circulation.

The Field Force consists of trained salesmen thoroughly conversant with their product who, under the supervision of division superintendents, cover the whole Western section of the United States, Canada and Mexico, maintaining personal touch with the readers.

The Promotional Service Division supplements the Field Force, sending out promotional matter from the main office to selected lists of prospects, and renewal notices. It is responsible for the proper classification of the readers which is essential to a technical publication.

Journal of Electricity and Western Industry stands heart and soul for the upbuilding of an electrical industrial empire in the West, and the Circulation Department in devoting its best efforts to spreading its message to every influential and responsible man in the field keeps constantly in view its slogan of "Readers — Not Subscribers."

Elizabeth A. Smith, general office department

Jennie Barton, general office department.

C. Adelaide Spencer, general office department.

Oscar Rosenblatt, general office department.

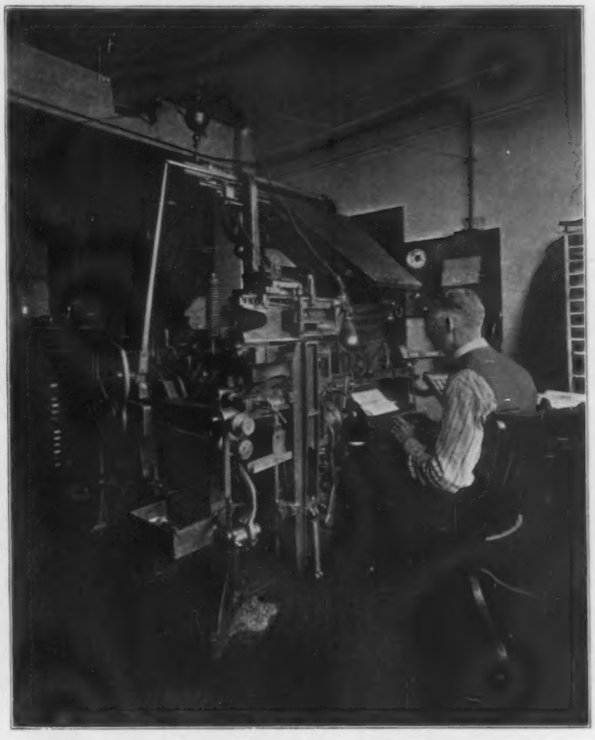
Charlotte A. Redmond, general office department.

Ruth Holman, assistant circulation department.

The editor's office, fifth floor, Rialto Building, San Francisco, where the editor and staff hold daily conferences with representatives from the subscription and advertising departments in planning the work of the paper. Representatives of all branches of the Western office hold a joint conference once a week in the official conference and committee room.

The main editorial room, where the Journal of Electricity and Western Industry is made ready for its semi-monthly appearance. Fourteen rooms in all are occupied by the various branches of the San Francisco office, eleven in the Rialto Building at Montgomery and Mission Streets, and three in the nearby Electric Building.

The entrance hall to the offices of the McGraw-Hill Company of California, fifth floor, Rialto Building, San Francisco. A complete library file of current McGraw-Hill publications is here available, as well as a stock of all technical books published by the McGraw-Hill Book Company. A detailed map of Western transmission lines occupies the wall to the right.



A section of the composing room showing the latest model of electrically operated Intertype machine. The former headquarters of the Journal of Electricity and Western Industry on the fourth floor of the Electric Building are now occupied by the mechanical department, where the magazine is set in type and made ready for the press.

SPARKS—Current Facts, Figures and Fancy

(In these days of strikes it will be refreshing to some of our discouraged readers to hear of a volcano which has erupted twenty-four hours a day for almost two hundred years. A potential competitor of Niagara has been found in the domestic water faucet, rubber will soon be possible of production in a white man's country, a tactful alarm clock has been invented, and bran is as good as concrete for repairing tanks—which we fully believe after trying bran bread. In fact, the world is still moving; see below.—The Editor.)

A world's record for work is held by Mount Sangay in South America, which has the distinction of being the most active volcano in the world. It has been in constant eruption since 1728.

* * *

According to recent statistics China now ranks third in the production of raw cotton, with nearly 2,000,000 bales of 150 pounds each. In 1919 the cotton area was increased by about 30 per cent.

* * *

The transmission of news stories by wireless, direct from reporters to newspaper offices, is becoming fairly common in England, and has led to experiments with instruments that will prevent wireless "eavesdropping".

* * *

The wireless telephone is rivaling the airplane as a means of preventing forest fires. In Canada four wireless land stations and five launch equipments are to be installed for the use of the British Columbia Forestry Branch.

* * *

A new form of illumination is that of London's aviation terminus, where an electric sign in the form of a star is sunk in the ground and covered with thick glass so that the airplanes can land on it without damage. From point to point the star is nearly a quarter of a mile in length.

* * *

Figures published by the Japanese Department of Agriculture and Commerce estimate the rice crop of Japan of 1920 as 325,130,619 bushels, showing, it is stated, an increase of 12 per cent over normal, or the average of the past seven years, excepting two abnormal years.

* * *

It is reported that the first gasoline-driven railway locomotive ever seen in Europe has just been put in operation on a Spanish line, making the run between Armagesilla and Fonselloso. The locomotive is of American make. It weighs thirty tons, develops a tractive power of 200 tons, has six drivers, and ran eighty miles an hour on its speed tests.

* * *

The newest hotel installation is a system of electric clocks embodying a call system which enables guests to call themselves at any desired hour. By simply setting an indicator at night, similar to an alarm clock, the automatic device rings a low musical chime at the desired hour in the morning. The clocks have luminous dials and hands so that the time can be read in the dark.

It is not necessary to go to the mountains for water power, according to a French scientist. He has conceived the idea of harnessing the humble domestic water faucet, which, he maintains, is capable of furnishing 1 hp. to drive an attached turbine and miniature dynamo. The device would come into action every time the tap was turned on, and the electrical energy generated would be stored in a battery of accumulators, to be used later for domestic purposes.

* * *

The motion picture industry is claimed to be the fifth largest industry in the United States and has had this spectacular development in 20 years. Over 800 millions of dollars were spent on movies by the people of this country last year and it is estimated that the receipts of the current year will total a billion. There are some 18,000 motion picture theaters in operation and 1,200 more under construction. The present daily attendance of these places of amusement is estimated at 11 million.

* * *

Rubber from milkweed is one of the latest possibilities opened up by research at the University of California. It is stated that a variety of milkweed has been found in the Mississippi valley that when dried yielded 7 per cent of rubber. Another variety was found in the hills back of Oakland that yielded from 2 to 5 per cent of rubber. An exceedingly promising variety was located on the desert in Southeastern California. Analysis showed that these weeds carry about 5 per cent of rubber. This variety thrives on the desert and it may develop into an excellent crop there, without reclamation and irrigation of the land.

* * *

Bran is now being applied to sterner purposes than filling pincushions and hungry rabbits, namely, the repairing of leaks in concrete water tanks. Two tanks were filled with water, and the pressure being greater on the inside faces than the outside, the water ran out through the leaks to quite an extent. Ordinary bran was used as a sealing material. The surface of the water all around the walls for a width of about 1 ft., was covered with bran. This bran floats for some time until it takes a gluish form, when it starts to sink, but very slowly, and in going down following the sides of the walls, the sticking substance is naturally drawn towards the holes into which it deposits itself, being forced in by the presure of the head of water in the tank. The operation was repeated until the tanks were made absolutely watertight. They have now been in use since November, 1919, and have not leaked at all since.

PERSONALS

E. S. Carman, president of the American Society of Mechanical Engineers, is a Pacific Coast visitor. Mr. Carman is chief engineer of the Osborn Manufacturing Company of Cleveland, Ohio, and is one of our best-known authorities on industrial management and the many intricate problems which have to do with present-day development in the industrial life of our nation. He comes to the Pacific Coast as the guest of honor of the Journal of Electricity at its anniversary dinner on the evening of February first at the Palace Hotel, at which time Mr. Carman will speak before a representative gathering of bankers, industrials, engineering and commercial men of the West. On Wednesday evening, Feb. 3, Mr. Carman will be the guest of the American Society of Mechanical Engineers at a dinner at the Engineers' Club. The organization Mr. Carman represents, the American Society of Mechanical Engineers, is today perhaps among the most forceful and constructive groups of our present-day engineering organizations.

J. A. Kahn, general manager, Capital Electric Company, Salt Lake City, attended the recent convention of the Pacific Division of the Electrical Supply Jobbers' Association at Del Monte.

C. E. Grunsky, the well known consulting engineer of San Francisco, has returned from the East where he has been attending the annual meeting of the American Society of Civil Engineers, of which he is a director.

William J. Barker, president of the Denver Gas and Electric Co., has been elected president of the Denver Motor Club for the year 1921. This is the fifth time that Mr. Barker has been chosen for this position.

Victor W. Hartley, formerly associate editor and advertising manager with the Sperry Flour Company, has been appointed assistant secretary of the California Electrical Cooperative Campaign. Mr. Hartley will take up his new duties on the first of February.

James T. Whittlesey, has been appointed director of the Pacific Coast branch of the Engineering Business Exchange, which has been established in San Francisco. Mr. Whittlesey has been engaged in general consulting engineering practice in San Francisco for the past eight years.

C. B. Hawley, president of the Salt Lake City Chamber of Commerce and vice-president and general manager of the Intermountain Electric Company, was in San Francisco on business during the last part of January. Mr. Hawley attended the convention of the Pacific Division of the Electrical Supply Jobbers' Association, held at Del Monte.

Albro Gardiner, Jr., has recently been elected president of the Seattle chapter of the American Association of Engineers. The other officers were elected as follows: Vice-presidents: R. H. Jones, Major O. A. Piper, Major Carl H. Reeves, and O. H. Kneen, Bremerton; secretary, E. L. Gines, Jr.; treasurer, H. W. Davies.

F. C. Finkle, consulting engineer for the proposed development of the Cajon Basin near San Bernardino, has made a report outlining two projects; first, the development of 1,000 horsepower at Mathews Lake, and second, the development of 770 horsepower at Vincent Cienaga. The first would cost $733,000 and the second, $767,000. No recommendations were made.

Charles S. Voorhees, formerly assistant Telephone Sales Manager of the Western Electric Company, is now the General Purchasing Agent of the Western Union Telegraph Company. Mr. Voorhees had been in the employ of the Western Electric Co. since November, 1895. He entered its ranks as a boy in the cashier's office in New York. Later he was connected with its switchboard and telephone sales departments, climbing into the executive circles in 1908.

Robert Dollar, president of the Robert Dollar Company, San Francisco; **John S. Drum,** president of the American Bankers' Association, San Francisco; **E. M. Herr,** president of the Westinghouse Electric and Manufacturing Co., East Pittsburg, and **Herbert Hoover,** president of the American Engineering Council of Federated American Engineering Societies, have been appointed members of the American committee of the International Chamber of Commerce.

John R. Brownell, superintendent of safety, California Industrial Accident Commission, has resigned his position with that body after five years of service to accept a position in the East with the Equitable Life Assurance Society. His position has been taken by H. M. Wolflin, formerly superintendent of the mining division. **G. Chester Brown,** who formerly served under Mr. Wolflin in the mining division, has now been appointed superintendent of that division. The position vacated by **Robert Eltringham,** who is now executive secretary of the California Electrical Cooperative Campaign, of superintendent of the Electrical division, has been filled by **George E. Kimball,** formerly an electrical inspector with that division.

W. J. Davis, Pacific Coast engineer of the General Electric Company, has been transferred to the International General Electric Company and will soon leave for London, and later for South Africa, where he will spend a year studying the proposed electrification of the present steam railroad between Cape Town and Pietermaritzburg, a distance of approximately 800 miles. It is also proposed to electrify suburban lines from Pietermaritzburg to Natal and Durban. It is understood that energy will be obtained from coal-fired steam stations if this line which is owned and operated by the government is electrified. Mr. Davis has been with the General Electric Company since 1895, when he entered the student's course. During the ten years from 1898 to 1908 he was part of the railway and traction engineering department and was engineer on some of the notable early electrifications. Among these was the Albany and Hudson electrification which was the first steam railroad to be electrified. Other electrification projects on which Mr. Davis was employed include the Central London, the London Underground, the New York Central, the Detroit River Tunnels, and the West Jersey and Sea Shore. Since 1910 Mr. Davis has been in charge of all General Electric construction and engineering work on the Pacific Coast. During the war he did especially notable work in marine propulsion and has been responsible for the installation in connection with the Los Angeles aqueduct and for the Great Western Power Construction.

James Raley Cravath has recently moved to the Pacific Coast from Chicago, on account of the health of a member of his family and is now residing in Berkeley, California. He is best known, nationally, as a consulting illuminating engineer, being one of the pioneers in that field, and an author of several books and numerous papers on such subjects. His engineering activities have covered a much broader field, however. He has been the chief executive officer of several public utility and ice companies. Mr. Cravath is the author of the sub-section on "Central Station Economics" in the Standard Handbook of Electrical Engineers. For ten years he was on the staff of the Electrical World at Chicago.

A. F. Gaward, manager of the British Electric Company, London, has been visiting in San Francisco during the past few weeks.

R. T. Stafford, manager of the Seattle branch of the Allis-Chalmers Company, recently left Seattle for the Milwaukee offices of the company.

M. W. Betteridge, operator, San Joaquin Light & Power Corporation, has recently been transferred from Power House No. 3 to the company's new substation at Merced.

W. G. Jaeger, who was formerly associated with Robert Gleason in The Lighthouse, a retail electrical shop in Tacoma. has recently purchased a half-interest in the concern.

Noel B. Martin, superintendent of the Sherman Electric Co. of Oregon, has resigned to practice engineering in Lewiston, Idaho. He will be succeeded by **Roy F. Dean** of La Grande.

W. J. Mackey, for thirty-two years, head bookkeeper of the Washington Water Power Company, has accepted a position with the Toledo Scale Company and will have his headquarters in Spokane.

George F. Sever, well known throughout the West as the one who had charge of the war industries work for the Pacific Coast, is now with Jackson and Moreland, engineers of Boston, Massachusetts.

A. B. West, vice-president and general manager of the Southern Sierras Power Company, has recently returned from Denver where he attended the annual meeting of the board of directors of that company.

H. A. Barre, executive engineer for Southern California Edison Company, left Los Angeles on January 12th for a three weeks' trip in the East which will include a visit to New York to attend the Engineering Committee meeting of the National Electric Light Association.

Frank Conrad, consulting engineer of the Westinghouse Electric and Manufacturing Co., has been appointed assistant chief engineer. Mr. Conrad has been connected with the Westinghouse Company for thirty years and has helped with the development of the company's measuring instruments, metering devices and radio equipment.

George L. Hurst, formerly manager of the dredging department of the Bethlehem Shipbuilding Co., Ltd., of San Francisco, has resigned his position with that corporation, and has taken up general mechanical engineering, with offices in the Balboa Building. **Peter C. Jurs,** manager of the mining department, will have charge of Mr. Hurst's work.

Laurence W. Davis, special representative of the National Association of Electrical Contractors and Dealers, is making a trip through the West and will speak in various cities before the local associations. Meetings will be held as follows: Tacoma, Wash., Feb. 3; Portland, Ore., Feb. 4; San Francisco, Cal., Feb. 7 and 9; Fresno, Cal., Feb. 10; Los Angeles, Cal., Feb. 11, and Phoenix, Ariz., Feb. 14.

H. P. Van Riper, of the Edison Electric Appliance Company, Seattle, spent the Christmas holidays in Southern California, immediately afterwards leaving for Chicago, where Mr. Van Riper attended the annual meeting of the Edison Company. Mr. Van Riper has charge of the Hot Point Division of the Edison Electric Appliance Company's Seattle office.

Ray Turnbull, of the Edison Electric Appliance Company, Seattle, recently left that city for Chicago, via San Francisco and Southern California points. The holidays were spent in California. Mr. Turnbull went from there to Chicago, where he will attend the annual meeting of the Edison Company. Mr. Turnbull has charge of the Edison appliances in the company's Seattle branch.

G. E. Quinan, Chief Electrical Engineer of the Puget Sound Power & Light Company, Seattle, attended the conference of Technical Committees of the N. E. L. A. held in New York City from January 17 to 21. Mr. Quinan is a member of the Executive Committee of the Technical Committees, vice-chairman of the Inductive Interference Committee, member of the Safety Rules Committee and a member of the Electrical Apparatus Committee.

Dr. Geo. L. Hoxie has recently accepted a position with the Southern California Edison Company in the capacity of Research Engineer to investigate sources of power.

Dr. Hoxie is a graduate of Cornell, M. E. class of 1892; also holding degrees of M. M. E. and P. H. D. from the same institution, of which he was for a time a member of the instructing staff.

Dr. Hoxie has been in independent consulting practice since 1905, and has shared his time between New York and Los Angeles. During the proceedings before the Railroad Commission in 1915, known as the Los Angeles Condemnation Case, Dr. Hoxie was retained by the Edison Company and made an exhaustive study of the company's properties, records and accounts. Dr. Hoxie will continue a limited amount of consulting practice, in addition to his work for Southern California Edison Company.

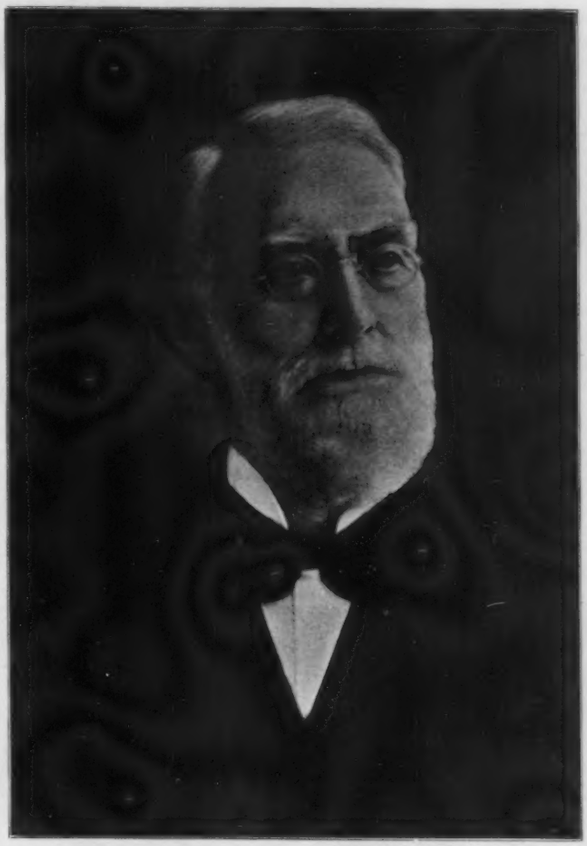
OBITUARY

A. J. West, pioneer Aberdeen, Washington, lumberman, builder of the first lumber mill on Grays Harbor, died in Aberdeen on January 11. Mr. West celebrated his 81st birthday one month previous. Mr. West achieved an enviable reputation due to his efforts in influencing the Northern Pacific Railway Company to construct an extension of their lines into the Grays Harbor Country. He is given credit for furnishing the labor and practically financing the work. He also bought, graded and sold to the C. M. & St. P. Ry. its present right of way to Grays Harbor.

Charles E. Gilmer, Foreman of Outside Construction of Seattle's Municipal Lighting Department, since its inception in 1904, died at his home in Seattle on January fourteenth.

Builders of the West—XCIV

THERE is a story of a young miner, back in the pioneer days of California, who was interrupted one morning by an inquisitive cow while he was operating a hose. To discourage the cow he turned the jet on her, and the way in which the water shot off her nose immediately inspired him with the idea of the divided bucket of the famous Pelton water wheel. The truth of this story is not vouched for by the most reliable authorities, but the fact remains that this great invention was conceived and perfected in California.



LESTER A. PELTON

Inventor of the Pelton Water Wheel

Very few authentic facts are available concerning the early history of the Pelton wheel. Lester Pelton, its inventor, crossed the plains from Ohio in 1850, and from that time until 1864 was engaged continuously in mining in California. Afterwards he took up mill wrighting in connection with mining at Camptonville, in Yuba County, and was employed there until 1878. During this time he constructed a number of water wheels of the "hurdy-gurdy" type then in common use in the mining districts, and having an efficiency of about 40%. He relates that one day the key which secured a wheel to its shaft became loosened, allowing the wheel to become laterally displaced so that the water struck the buckets on the inner side. He observed that the stamp mill which the wheel was driving immediately ran faster, and he thereupon began to speculate upon the possibilities of improving the efficiency of the wheels by changing the shape of the buckets.

Stories are told of how, all through the winter which followed, he spent his nights by a little stream experimenting with buckets shaped by hand from tin cans and attached to the rim of a small wheel. He devoted a great part of his time for the next two years to designing a higher efficiency bucket, making a trip to Berkeley, where various tests were made at the University and a model wheel built. In 1880, after securing a patent, he introduced his wheel to the public, but it was not until some time later that the Pelton Water Wheel Company was founded in San Francisco. Lester Pelton died in 1910, but the company still bears his name.

From the time of its first introduction the Pelton wheel increased steadily in popularity. In 1884 the Idaho Mine, near Grass Valley, invited tests of all waterwheels then in use, and the Pelton wheel developed an efficiency 19 per cent above the best of the others. The report of the State Mineralogist in 1888 devotes considerable space to the Pelton wheel, and in view of the high heads since developed in the West the following quotation from the report is of interest:

"A most interesting application of electric transmission for mining uses is about to be tested on the great Comstock lode at Virginia City, Nevada . . . A forty-inch Pelton wheel . . . will be run under a direct vertical pressure of 1,630 ft. . . . The wheels for additional security are made of phosphor bronze, and will run at 9,000 r.p.m. The Pelton wheels are expected to work up to full 90% efficiency. This is perhaps the first attempt made to run wheels under such enormous pressure."

In 1895 the Franklin Institute published an exhaustive report on the Pelton Wheel, and awarded the inventor the Elliott Cresson Medal. The award of this medal, reserved for the most significant contributions to scientific progress, ranks the invention among the landmarks of engineering achievement, and those who have followed the history of hydroelectric development in the West know that this distinction is merited. It is natural that the tangential water wheel should have originated in California, where limited quantities of water at high heads constituted practically the only form of water power available for the working of mines and mills. That it should have been perfected in the West, to the point where it figures in more than one world's record installation is characteristic of the enterprising spirit which later engineers share with the inventive young miner of the pioneer days.

Interesting modern developments in the West include a 550-hp. Pelton impulse turbine in a synchronous generator plant which is completely remote-controlled from a point 3½ miles distant. Another Pelton impulse turbine in Honolulu receives water simultaneously from two different points under two different heads, as does also a Pelton turbine in Southern California. High head reaction turbines, also, of the Pelton design are among some of the most notable features of record hydroelectric developments in various parts of the United States.

The whole of Western progress is bound up with the harnessing of Western water power, and there is perhaps no invention which has played, and is still playing, a greater part in this work than the Pelton Water Wheel.

HAPPENINGS IN THE INDUSTRY

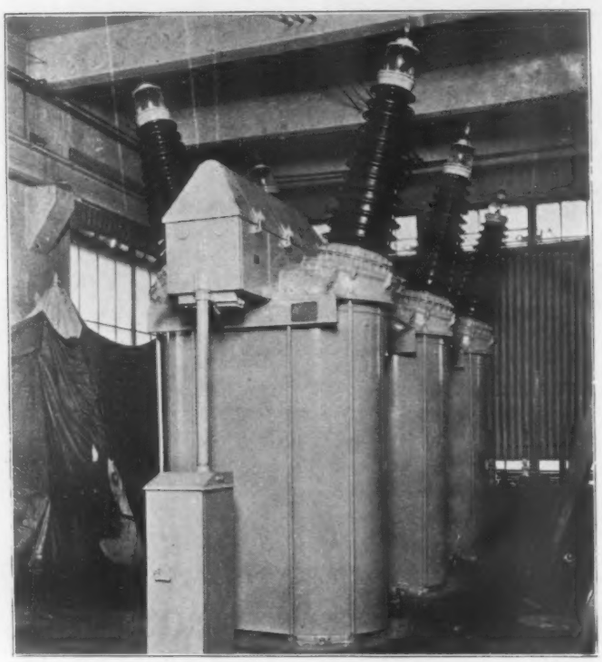
SOUTHERN SIERRAS PLANS EXPENDITURE OF $2,000,000

The annual budget of the Southern Sierras Power Company plans the expenditure of $2,183,329, of which $1,836,987 will be spent in new construction and the remainder will be spent in finishing work now under way. Work will be continued on the developments on Leevining creek, Owens river gorge and other places without let-up.

Items in the budget include $600,000 for additional hydroelectric developments including work in Leevining Creek Plant No. 1.

Additions and improvements to the distributing system in the Imperial Valley call for $208,000, including an appropriation of $60,000 for rebuilding distribution lines and $50,000 for increased transformer capacity at the El Centro terminal station. There is also an item of $80,000 for distribution transformers to serve consumers of the Southern Sierras.

Improvements and additions, substations, and extensions to serve consumers on the Southern Sierras, call for $100,000.



LARGE OIL CIRCUIT BREAKERS

One of the seven gigantic oil circuit breakers, built by the General Electric Company, for the Great Western Power Company's Caribou Plant. The breaker is solenoid operated, and is built for operation at 165,000 volts, 400 amperes, at any altitude above sea level. These breakers are believed to be the largest of their kind in the world.

WEATHER FORECASTING CONFERENCE TO BE HELD IN SAN FRANCISCO

A Weather Forecasting Conference, which will be of interest to power companies and irrigationists, will be held in San Francisco on the afternoon and evening of February 18th. The meeting will be held under the auspices of the National Technical Section of the N. E. L. A., in conjunction with the engineering committee meeting of the Pacific Coast Section. The Commercial Club has been designated as the tentative headquarters of the conference.

The reports and investigations will cover the forecasting of rainfall for months ahead, based on studies made by the University of California through its Scripps Institute at La Jolla, where Dr. W. E. Ritter and G. F. McEwen have investigated the relation between oceanic phenomena and the subsequent precipitation on the western slope.

WORK STARTED ON WASHINGTON WATER POWER COMPANY'S NEW PLANT

Actual construction has been started on the new plant of the Washington Water Power Company which is being built in the city of Spokane. The plant will have a capacity of 10,000 kw. and will feed directly into the 4,000-volt bus of the Post Street substation. Grant Smith & Company have the contract for construction of the dams, headgate works and power house. The designing is being done by the engineering department of the Washington Water Power Company. Construction work has been started and will be pushed in order to have the plant in operation by October or November. The work is also relieving the present surplus of labor situation in the city.

POWER LINE TO BE BUILT IN IDAHO

Arrangements have been completed whereby a 44,000 volt power line will be built to the Vipont Silver mine from Oakley, Idaho. As soon as the power line is completed electric power will be used instead of the semi-Diesel engines which have hitherto driven the machinery necessary for mining and milling operations.

The Idaho Power Company will build the line from Oakley, Idaho, to the Utah line, from which point the mining company will complete the work to the mine, a distance of about three miles. The total length of the line will be about twenty-one miles.

Installation of electrical power equipment will effect a considerable saving for the mining company. Hitherto the company has had to haul considerable supplies of fuel oil a distance of twenty-six miles, and the transportation has been difficult, due to the mountainous country through which part of the route to the mine passes.

PLANT NEAR BAKERSFIELD PROGRESSING RAPIDLY

Good progress is being made by the San Joaquin Light and Power corporation in the construction of the first unit of its new steam plant at Buttonwillow. It has been stated by the engineers that the plant will be finished by May 1, and perhaps the "load" will be turned into the main line by April 15. About 160 men are now at work on the job, and over a million dollars is being expended.

The new unit will develop 12,500 k.w. or about 78,000 horsepower, more than enough electricity to provide light and power for the city of Bakersfield. When it is realized that the Bakersfield steam plant, just completed, now has a capacity of about 24,000 kw. or about 35,000 horsepower, and the Kerckhoff plant a minimum of 36,000 kw. or about 54,000 horsepower, it can be seen how much added power has been developed by the company in the past year.

A. G. Wishon, who paid a visit to the Buttonwillow project yesterday, stated that undoubtedly there will be four units at Buttonwillow in time instead of one, and that probably another unit will be constructed next year.

Two hundred and fifty men are being employed on the work at the power company's plant in the Kern River canyon. The tunnel is being lined and arrangements are being made to shoot the water through it under pressure so that a larger volume will be carried.

PLANS FOR DEVELOPMENT BY THE CITY OF LOS ANGELES

A special committee of the Los Angeles Chamber of Commerce has recommended an expenditure of $100,000,000 for the municipal development of nearly a half million horsepower. The city engineers, who have for some time had this scheme under consideration, state that an idea of the vastness of this development can be obtained by recalling that the development of power from the Niagara Falls totals only half the amount of power which Los Angeles will acquire if the entire plan is executed.

UTAH INCREASES OUTPUT OF COAL

Coal production of Utah for the year 1920 exceeds that of 1919 by approximately 1,200,000 tons. The total output for 1919 was 4,629,722 tons and the estimated total for 1920 was 5,818,950 tons. It is calculated that under normal conditions, with an adequate car supply, favorable market, and without interruptions on account of mine disability, labor shortage, strikes, etc., the present capacity is 8,758,922 tons. A large percentage of the coal mined in Utah comes from the Carbon County coal fields, where practically all the coal companies use electric power in their operations.

PERMANENT COMMISSION FORMED TO FURTHER COLORADO RIVER DEVELOPMENT

With the expressed aim of getting concerted action by all parties concerned, a commission was organized in Salt Lake City on January 21, to further the development of the power and irrigation possibilities of the Colorado River and its tributaries. A tentative bill was adopted by the commission to be presented to the legislatures of Utah, Colorado, Nevada, Arizona, Wyoming, California and New Mexico, calling for a permanent appointment by each state of a representative on the commission. A copy of the bill will also be sent to Congress, that a Federal representative may also be appointed.

Frank E. Weymouth, chief engineer of the Reclamation Service of the United States Government, has been selected as secretary of the organization. The present members pledged themselves to supply him with all the available data concerning the project, both present and prospective. This information will be made the basis for concerted action to be determined upon at future meetings of the commission.

SOUTHERN CALIFORNIA EDISON TO ISSUE $10,000,000 GOLD BONDS

Authorization to issue $10,000,000 face value of its general and refunding mortgage 6% 25-year gold bonds has been granted to the Southern California Edison Company by the California Railroad Commission. Permission is given the company to use not exceeding $3,000,000 of the bonds as collateral security for the payment of short time loans.

Testimony at the hearing of the company's application was to the effect that it would expend $8,000,000 for hydroelectric development in 1921 and that its expenditures for general additions and betterments to take care of the ordinary increase in the company's business would range from $4,000,000 to $6,000,000. To permanently finance properties already constructed and to carry forward its construction program during 1921 the company estimates it will have to raise approximately $20,000,000.

MOUNT SPOKANE POWER COMPANY STOCK ISSUE

For the purpose of raising money to carry on construction work the Mount Spokane Power Company of Deer Park, Washington, have issued $50,000 worth of 7% prior preferred cumulative stock. The construction plans call for the immediate expenditure of $12,000 to increase the size of their plant which is due to the increased demand for power and to take care of the contracts which have been signed up for the coming season.

EXAMPLE OF OUTDOOR ILLUMINATION

The example above of the Hamilton Store of Albany, Oregon, is a splendid instance of what can be done in the way of outdoor seasonal illumination. This store is conceded to be one of the best in the Willamette valley, and draws trade from a radius of fifty miles. Since the population of Albany is only 6,000, the elaborateness of the decorations is rather exceptional for a town of that size.

NO BIDS RECEIVED ON SKAGIT BOND ISSUE

No bids were received for the $2,005,000 Seattle city light extension and Skagit bonds recently offered for sale. While the city officials still have hopes of disposing of the bonds some time this year, steps are being taken to provide funds from some other source to carry on the work of construction. The force on the development has been reduced to the lowest possible minimum and the only work now in progress is the construction of a tunnel for temporary power purposes and the building of the railroad from Rockport to the power house site.

EDUCATION OF PUBLIC TO ELECTRICAL IDEA BY MOVING PICTURES

The General Electric Company has a series of moving picture films of an educational nature which have been widely distributed from their San Francisco office. Films from seventeen scenarios were shown in 774 theaters on 1,069 days during the year 1920. Some of these films were shown more than once per day. The total number of showings was 2,380; the total number of people seeing these films, 597,009. This is the record for California alone. Throughout the Pacific Coast, 875,251 people saw these films. That these films were not only educational but also interesting, and their use attractive to the motion picture theater owners, is shown by the fact that this figure of 875,251 is an increase of approximately 500,000 over the number of people who saw the films in the year 1919.

A wider use of moving pictures is planned for this year by the power companies as well as the other branches of the industry, and should be a powerful factor in the education of the public.

POWER COMPANY GIVES LIGHT DEMONSTRATION IN BOULDER

Over 100 persons attended the demonstration given in Boulder, Colorado, on Jan. 12 by the Western Light and Power Company, of improved methods of interior lighting. All of the latest developments in diffusion of rays, concentration of rays on the working plane, and fixtures of direct and indirect lighting, were demonstrated. In addition, a new light, called "True-tint," especially adapted for use in dry-goods stores for matching of colors and materials, was shown, and samples of cloth of the most difficult shades for matching under artificial lights were used.

The demonstrations will touch upon the subject of psychology of lighting on the efficiency of employes in places of business, pointing out the advantages to be obtained in increasing production from employes when the light in which they work is regulated to be most pleasing to them.

INTERESTING THE PUBLIC IN UTILITY PROBLEMS

The clippings shown in the accompanying cut were taken from the Martinez (California) Gazette and show the extent to which the problems of the public utilities are being considered by the public. This type of publicity is very effective as it not only interests the public but carries the idea that over-regulation is as bad as no regulation at all, and shows that the woman voter is a good person for the public utilities to make friends with.

MONTANA ENGINEERS OPPOSE LICENSE LAW

At the regular meeting of the Montana Society of Engineers held in Butte in January considerable time was given to the discussion of the proposed license law which is now being considered by the State Legislature.

Discussing the proposed license law, Prof. Clinton H. Moore, one of the oldest members, characterized it as superfluous legislation, resulting in added bureaus and expenses to the state and working a general hardship on engineers and employing companies.

"There are eleven states which now have such laws," he says, "and in none of them have favorable results been accomplished. As far as elevating the profession, it would not have this effect, for there are numerous professed engineers who could pass a perfect theoretical examination and yet be entirely unqualified for practical work."

The law as introduced provides for examination of engineers and includes dues of $5 annually and an admittance fee of $15. A similar law is also being considered by the Arizona Legislature.

SUPERIOR COURT UPHOLDS RIGHT OF CITY TO CONDEMN

The right of the city of Tacoma to condemn property for the acquisition of the Lake Cushman power site has been upheld in the Superior Court by Judge John M. Wilson, and the necessary legal steps to protect the city in all the details connected with the power site project have been concluded. The city will now take an order of the court authorizing the bringing of a condemnation suit, and start without delay the suit to acquire all the lands which cannot be obtained by purchase outright, including lands, water rights, dam sites, transmission line franchises and other rights needed for the development of the Lake Cushman site, for the sum of $300,000.

Attorneys seeking to block the city's efforts to condemn the site, took the stand that the law provided that a city may condemn a power site only if it proposes to make public use of the power, and pointed to the fact that if the city discontinued the sale of power for use of toasters, household devices, curling irons, etc., the city would have sufficient lighting energy for years to come. In handing down his decision, Judge Wilson said, in part:

"I cannot agree with the contention that the use of electricity in the homes of the inhabitants of the city for heating, toasters, carpet sweepers, curling irons, and the like is not a public use in the light of the rapid development of electrical uses of the present day, nor do I think there is such a showing of the commingling of public and private uses as would preclude the petitioner's right to condemn."

As soon as the site situation is cleared up, Commissioner Davison, of the light and water department, will ask the council to approve an appropriation to begin the engineering work on the big power development. The engineering work so far is purely preliminary, and a mass of detail work must be done, test borings of the dam site made, and other data prepared, before the actual construction, which will necessitate a utility bond issue, can be started. The city cannot hope to have delivery of power from Lake Cushman under two years, it is stated.

APPROPRIATIONS GRANTED FOR NORTHWEST DEVELOPMENT

An appropriation of $400,000 has been allowed the house appropriation committee for beginning construction on the Deschutes project in Deschutes, Crook and Jefferson counties, Oregon. For the Klamath project, an appropriation of $1,213,000 has been recommended and the Umatilla project has received $467,000. An appropriation of $25,300 has also been recommended for Crater Lake National Park.

SOUTHERN CALIFORNIA EDISON SURCHARGE REDUCED

A temporary reduction in rates of the Southern California Edison Company of Los Angeles was ordered by the State Railroad Commission in San Francisco, according to dispatches. The commission, in its order, reduced the surcharge of 27 per cent in effect for approximately a year because of increased operating costs, to 20 per cent.

WASHINGTON COMMISSION DECLARES UTILITY SERVICE CHEAP

In the annual report of the Washington Public Service Commission the statement is made that the cheapest commodities purchased by the people of the state are those furnished by the public service concerns, according to the report of the Public Service Commission, made public today. The report says the last year has been one of trying and gruelling work for the Commission and points to the need of the utilities for increased rates and the popular opposition to the increases. Many of the concerns, says the report, sought to tide over the war period without increased rates, hoping for a return to normal prices with the return of peace.

"The return to normal has been slow. During the last year we have held investigations, where the facts compelled us to choose between bankruptcy for the utility, or increased rates. We could perhaps have gained a momentary popularity by denying the increase and closing our eyes to the inevitable results, but we have chosen to save utility investments from disaster, where possible, and preserve a necessary service to the public. In many instances the increases permitted have been inadequate and limited to experimental periods in the hope that a speedy return to normality would enable the utilities to resume former rates without financial loss.

"The temptation to refuse even necessary increases is often strong. In many cases we are conscious that thousands of patrons, often imbued with the fixed belief that the utilities' requests for increased revenues are the result of greed rather than necessity, await our order with flattering approval or harsh derision. He would not be human who would not prefer approval, but he who would depart from the path of duty to obtain it would be unfit for a position of responsibility."

The Commission also describes its successful fight, with the aid of the Commissions of Montana and Idaho, against an increase in express rates of 25 per cent.

"Practically every state in the Union except Washington has a law conferring the issuance of a certificate of convenience and necessity for the establishment or abandonment of public utilities. Regulation can not be efficient where the regulatory body lacks the authority to prevent needless duplication of public utilities. Several instances have come under our observation where we have been called upon for increases in rates which would be unnecessary except for a needless duplication of facilities, which would not have existed had the certificate of convenience and necessity been a requirement of our statute.

"Our work during the year from the standpoint of the number, importance and scope of the problems we have been called upon to solve, has been the greatest in the history of the Commission."

ANOTHER ARGUMENT FOR CONVENIENCE OUTLETS

An enterprising electrical dealer of Sacramento, California, has capitalized on one of Fontaine Fox's clever cartoons to help sell the idea of the convenience outlet to the public. A cartoon is always read and provides an unusually effective means of telling the story.

LUMBER COMPANY INSTALLS NEW LIGHTING SYSTEMS

To insure greater efficiency and as a safety first measure, the Dalkena Lumber Company, Dalkena, Wash., has recently completed the installation of a complete new electric lighting system, at a cost of approximately $3,400. The work was done by the Citizens' Electric Company of Newport.

The Benjamin 500-watt unit is used on the main floor and the basement has 100-watt tungstens. The wiring is all in conduits. The planing room has 22 500-watt lamps, the stock room 6, the grading platform of the stock room 6, the engine and boiler room three each, four in the filing room and two on the driveway to the planer, making 46 in all. The basement and car loading platforms have over a hundred 100-watt lamps.

This is the first lumber company in the district to install so complete a system. It insures a greater output per man, greater safety to the individual employe and decreased danger of fire due to defective wiring.

LOS ANGELES COMMITTEE ON SAFETY MATTERS FORMED

The Joint Committee on Electrical Safety Matters recently appointed a Los Angeles sub-committee to act in that locality. The following representatives were chosen by their respective organizations: National Electric Light Association, Fred Lewis, Southern California Edison Company; Contractors and Dealers, G. E. Arbogast, F. E. Newbery Company; Manufacturers, J. H. Fenton, Westinghouse Electric & Manufacturing Company; Inspectors, H. M. Beecher, City of Los Angeles; Jobbers, E. W. Sherman, Illinois Electric Company; A. I. E. E., E. R. Northmore, Los Angeles Gas and Electric Company. One member-at-large is yet to be chosen.

INDUSTRIAL COUNCIL FORMED IN MONTANA

The Montana Industrial Council was formed in Helena on January 11 at a meeting at which more than twenty state bodies were represented. Meetings will be held periodically and matters concerning the best interests of the state will be discussed. John H. McIntosh of Butte was elected chairman and A. T. Hibbard of Helena, secretary. These temporary officers will sit until a meeting to be called for some date in February, when permanent organization is to be effected.

SNOWFALL IN CALIFORNIA

Light snow fell in the Sierra Nevada Mountains during September and October, 1920, and moderately heavy snow fell during November. At the close of November there was about 22 inches of snow on the ground at the 8,000-foot level, and deeper snow at greater altitudes.

During December heavy snow fell throughout the Sierra Nevada. About 100 inches of snow fell at the 7,000-foot level, and larger amounts fell at greater heights. Most of the precipitation in the higher mountains came in the form of snow. The month was cold, and temperatures below zero were common. As a result, there was little run-off from melting snow in the Sierras. At the close of the month the snow was well packed, and there was more snow on the ground than on any similar date since 1916. The greatest snowfall reported for the month was 125 inches at Tamarack, altitude 8,000 feet.

Little snow fell in the mountains of southern California, and only scattered patches of snow covered the highest peaks at the close of the month. Precipitation was markedly deficient throughout the southern portion of the state, and the accumulated seasonal amount was less than half of the normal on January 1, 1921.

NEW ELECTRICAL STORE

Richmond, California, has added to its list of attractions the East Bay Electric Company's store which was recently opened in that city. The accompanying picture was taken and shows the proprietors, Mrs. Katherine Tefft, A. Duggan and B. L. Spurr with their smiles of welcome.

IDAHO PUBLIC UTILITIES COMMISSION ANNUAL REPORT

The annual report of the Idaho Public Utilities Commission shows that numerous public questions were settled by the Public Utilities Commission last year. Ninety-four cases requiring formal hearing were filed and ninety-six orders were issued. Approximately 300 informal cases and complaints, many of which called for conferences or informal hearings, were filed and practically all adjusted.

These cases involved passenger, freight and express rates; telephone and telegraph rates; electric power and water rates, etc. One hearing involved the change of time for the entire state, while not a few had to do with ore rates.

Business Activities in Western Market Centers

The decline in commodity prices last month offered additional relief from the pressure due to the high cost of living. It will take some time, however, for the fall in merchandise prices to bring about a thoroughgoing reduction in bank loans. The price curtailment campaign has evidently not yet been completed, although in some branches the downward trend has reached a level which indicates that the movement may be nearing its end. This is encouraging and when the movement progresses far enough there should be a material increase in consumption. The whole trade situation is being helped by deflation, which, although operating to increase commercial failures, is reducing living costs and gradually eliminating various evils resulting from war excesses. The money outlook favors slightly easier conditions, although the credit strain is still acute, owing to the existence of a great volume of frozen loans in agricultural, industrial and commercial lines. This situation is, of course, being progressively relieved, but considerable time must be required to restore reasonably normal conditions and to eliminate abuses.

SAN FRANCISCO

Retail trade in San Francisco showed good volume during the month of January, and since the holidays price cutting and clearance sales have continued to attract purchasers so that business has been active.

In general the retailer in San Francisco has reason to congratulate himself on the results of his 1920 business. Market conditions during the year have been unsettled, prices have tumbled and while many retailers have been compelled to write off substantial losses, they had in general trimmed their sails months in advance and were prepared to meet any loss that might occur. The wholesale and jobbing trade is still quiet, although some improvement is being felt at present. Better trading is anticipated in the near future, on the theory that retailers will soon be obliged to replenish depleted stocks while prices have now about reached a point where the trading level can appeal to purchasers as being equitable.

Collections in most lines are reported good.

The rice market continues to decline and sales of fancy head rice were recently reported in San Francisco at $3.27, which approximates the figure paid for paddy at the opening of the season.

On the other hand consumers are reported to have allowed their stocks to run extremely low and since the turn of the year the markets have begun to show improvement. Beans, dried fruit and canned goods are beginning to move in larger quantities and a noticeable firmness is being reported in other directions. The wool market, which has been practically dead for some months, is beginning to pick up and small quantities are being moved.

The bean market appears to be in better position than any of the others at the present moment.

LOS ANGELES

The slowing down of business which is reported in the East is not yet reflected in Los Angeles. Trade continues brisk after the holidays with a number of apparently sincere sales at reduced prices to stimulate buying. Automobiles and similar high-priced articles are not so active. In the electrical field the wiring and fixture business is good, due to continued building activity while appliances are not selling so well. Dealers and shoppers are waiting for reduced prices on appliances. Heavy frost on the nights of January 12th and 13th did little damage as the citrus growers kept their groves warm by smudging. Rain would be welcome, but its absence has not caused any worry to date.

National Banks in Los Angeles and immediate vicinity report total deposits of $152,814,000 with available cash totaling $46,200,000. The January analysis of business conditions issued by the Merchants' National Bank says that Los Angeles is probably the most fortunately situated city of its size in the United States to weather the period of readjustment now confronting the country. Collections in most lines are reported good.

PORTLAND

Portland rounded the turn of the year with full expectation of a gradual and steady recovery from the "lull" which has characterized the readjustment and liquidation period of the last few months of 1920.

It cannot be said that Portland or its supporting territory has suffered any "business depression". There has been a slackening in some of the leading industrial lines and commodity prices suffered materially from the consumers' strike, but the traditional conservatism of Portland business interests, banks industrial enterprises and the community as a whole prevented any unsound inflation and expansion so that when the readjustments, inevitable as they were, did come, they were not in the nature of a shock, for the community was prepared for exactly what happened.

Foreign exports reached unprecedented totals for the year just past and there is every indication of a big year ahead for this port.

Shipbuilding activities in two large local yards are maintaining a working force of 8,500 skilled artisans at peak war wages and they have contracts carrying on well into the middle of summer on the present basis.

Jobbing and wholesale lines bought conservatively for the fall and holiday trade and maintained a volume of business well up with that of 1919, and the actual volume of business in retail lines was about on a par with that of 1919 and considerably above normal.

While the labor shortage has been converted into a labor surplus by the curtailment of production in some lines and through the usual mid-winter shutting down of logging camps and mills for the usual overhauling process there is no unemployment problem in Portland this winter. The number of idle men in the city now is just about normal for this period.

SEATTLE

There is a well-defined streak of optimism throughout the lumber industry in the Northwest, based upon the belief that financial credit will ease; that the unsatisfied demand for housing and other construction will soon assert itself; and that the lower water rates taken in connection with the establishment of lumber-handling facilities at Atlantic ports, will enable West Coast lumber to be sold freely in East Coast markets.

However, with financial conditions

temporarily retarding new construction, adverse exchange operating against exports, and advanced freight rates restricting the use of West Coast lumber in markets east of the Mississippi, the outlook for the first quarter of 1921 is not too encouraging.

Reports from sawmills of Washington and Oregon received about the middle of January shows considerable resumption of operations following midwinter closedown. Lumber, the middle of the month, quoted at dimensions $25 to $27, timbers, $35 M, and common $27 M, with a very light demand.

Building operations in Seattle and Puget Sound country are at a minimum. Construction of moment, such as industrial plants, and business buildings is at a standstill, and residence construction very light.

Cutting of wages in this district is general. Mills which have resumed operation in most cases are paying the minimum prescribed by the Loyal Legion of Loggers and Lumbermen, which is $3.60 for common labor. Unemployment situation has not improved. In Seattle, unemployed list is estimated from 12,000 to 15,000. Local wheat and flour shippers were offering shipments during January at the rate of $15 a ton to the United Kingdom and $16 to Mediterranean ports, following the cut from $18 to $16 a ton made by the Shipping Board.

SPOKANE

With the first few days of the new year, business in the Inland Empire seemed to pass the peak of the load under which it has been struggling for the past several months. Business men and bankers at this writing have a better feeling than in some time.

Wheat which the farmers have refused to sell at current prices and which millers have refused to buy, has begun to move in appreciable quantities and is having the effect of starting liquidation and lessening the strain under which the banks of the district have labored. The farmers last year planted high-priced seed and were forced to pay exorbitant wages, so that wheat selling today at $1.40 to $1.50 per bushel represents a very small margin of profit and possibly in some instances actual loss. Seemingly now, however, farmers have begun to believe that prices are not going to resume their former high level and are beginning to pocket their paper losses by selling their wheat.

Lumbermen differ in their outlook according to the individual from extreme pessimism to rosy optimism as to the 1921 lumber outlook.

Merchants generally report a very satisfactory holiday trade.

With the break in the wheat deadlock, the worst is by way of being mended and the general feeling is one of optimism for 1921.

BUTTE

The stagnation of the copper market and the consequent accumulation of large stocks of copper has had its effect on the mining industries in this section. Many of the mines in this district have closed, and the remainder are running short-handed. It is estimated that the surplus stocks of copper will reach 700,000,000 pounds.

The Montana Wool Growers' Association have decided, according to a statement given out by Senator C. B. Williams, to ship their wool East and make it into blankets and cloth suitable for men's and boy's suits. Two carloads of wool have already been shipped East and as an experiment has been made into cloth. The cost of the cloth has been $11 and the labor $25, making the cost of the suits $36 without any profit for the tailor or the manufacturer. This yields, however, 45c per grease pound to the grower. The association, in attempting to demonstrate that wool can carry a fair price and still supply an excellent quality of goods that will be within reach of the majority of the public. Every suit will bear the Montana Wool Growers' Association guarantee that it is made of all Montana-grown wool.

SALT LAKE CITY

With the recovery of the morale of business since the turn of the year Salt Lake City has seen ever-increasing indications of the attainment of more normal relationships in industry and commerce and there comes a feeling that the time is rapidly approaching when definite steps for the future may be taken with assurance.

It cannot be maintained with any showing of facts that the adjustment process has been completed, for there yet remain many parts of the body economic which have yet to resume functioning in harmony with the whole. But the indisputable evidence shows clearly that the process is accomplishing its purpose steadily, that every day brings additional facts to light which show that the economic position of the intermountain section and of the country at large is improving consistently.

The low levels have been reached in the copper industry, and a revival should set in within the next few months, was the opinion expressed by D. C. Jackling, managing director of the Utah Copper Company, in a recent interview in Salt Lake City.

Speaking of Utah Copper Company affairs in particular, and in the main embracing all the other low-grade porphyry mines under his supervision, Mr. Jackling said: "Naturally it is necessary to retrench, to keep the organization going at all. We shall not close down entirely. We have no idea how long this depression will last in the copper market. We shall keep on as far as is possible, and retain as many of our old employes at work as we possibly can."

Referring to the zinc industry Mr. Jackling said that the high freight rates now in effect will undoubtedly result in the building of large zinc reduction plants in the West.

As the new year advances the general feeling is bettered, more confidence is gained, new courage revealed. And with the exhibition of sound judgment, level-headed common sense which has made the transition period far less difficult for the intermountain country than many other localities, this same region can expect to prosper comparatively in the months of 1921 to come.

DENVER

The general price situation in this district is still uncertain, and merchants have been cautious in placing orders for future delivery. Banking circles reflect a spirit of optimism, and officials express the opinion that business is well over the most difficult period. About $12,000,000 in rediscounts held by the Federal Reserve Bank of the Rocky Mountain district has been recently taken up by the member banks. "That this liquidation could take place despite the unusual and severe commodity price declines, which have arisen during the crop-moving period, is indication itself of the fundamentally healthy condition of the district," said the manager of the Federal Reserve Bank. The tax period and the end of the year settlements have been accomplished in the district without dislocation, and one of the most hopeful indications is the fact that the banks can tell just where they stand. With this confidence on the part of the banks business is sure to reflect the attitude. There has been a temporary decline in mining and smelting activities throughout the district due to the cutting off of contracts for manganese ore, but lessees are confident that it will be of short duration.

Meetings of Men in the Industry

(San Francisco section of A. S. M. E. to hear national president. Proposed Electrical Inspection Bill in California receives endorsement of Electrical Development League, and state Contractor-Dealers. Northwest societies report interesting meetings. Executive committee meeting of Pacific Coast Section of N. E. L. A. set for February second.—The Editor.)

Capital Electric Company Conducts One-Day Convention at Salt Lake

An enthusiastic convention, with a banquet in the evening, of all the salesmen of the Capital Electric Company, together with several specialists representing the General Electric Company, was held at Salt Lake City on January 3.

Group of salesmen of the Capital Electric Company and representatives of the General Electric Company at their recent convention in Salt Lake City

The keynote of the convention was optimism, with a hopeful outlook for business during the coming year. Salesmen from every section of the territory covered by the company exchanged ideas and were given an opportunity to report their activities for the year just closed. J. A. Kahn, general manager, delivered an address, in which he outlined the policy of the firm and pointed out the significance of the company's new home.

Several specialists gave lectures and demonstrations on subjects of particular interest to the electrical trade. Everyone left the convention with a feeling of confidence over the outlook, and a determination to spread the propaganda of optimism and make 1921 a banner year.

Executive Committee Meeting February Second

The Executive Committee of the Pacific Coast Division of the National Electric Light Association which was called for January 21 in Los Angeles, will be held in San Francisco February 2, in the Palace Hotel at 10 a.m.

San Francisco A. S. M. E. to Hold Interesting Meeting

The next meeting of the San Francisco section of A. S. M. E. will be held at the Engineers' Club February 3 and will be preceded by a dinner given in honor of E. S. Carman, national president of the American Society of Mechanical Engineers, who will address the members on the subject, "Engineering Opportunities in America's World-wide Activities." Following Mr. Carman there will be an address by Prof. William H. Wright of Lick Observatory, Mount Hamilton, on the subject of a recently perfected astronomical instrument for determining the exact dimensions of stellar bodies, the work of Prof. A. A. Michelson of the University of Chicago. By these methods the diameter of Alpha Orionis of the constellation of Orion has been determined as two hundred and sixty million miles, a distance greater than the earth's orbit around the sun.

Seattle Engineers Hear Illustrated Lecture

At the regular monthly meeting of the Washington State Section, American Society of Mechanical Engineers, held in the Assembly Hall of the Chamber of Commerce, Seattle, January 20, Chief Engineer C. F. Uhden of the Skagit River Project, of Seattle's municipal light and power development, gave an illustrated talk of the work now in progress on the Skagit. Mr. Uhden's talk was accompanied with 75 slides not previously shown.

Engineering Service Offered Spokane

The Associated Engineers of Spokane at a regular weekly luncheon framed a resolution which offered to the city of Spokane their services and cooperation on all public questions, particularly those involving technical matters.

The resolution states that the Associated Engineers of Spokane are desirous of rendering a service to the public that is accurate, fair and impartial on matters of public welfare, public improvement, public betterment and public relations wherever their technical training will better qualify them to handle such questions.

Oregon Drainage Men Meet

The Oregon State Drainage Association held its annual convention in Portland January 9, at which time problems affecting reclamation and thorough drainage were discussed by experts.

Irrigationists and engineers from Oregon, Washington and Idaho were in attendance. Proposed legislation which will be brought up at the next session of the Oregon Legislature was discussed, as well as other matters affecting the work of the organization. Officers elected were: Samuel H. Brown, president; W. L. Powers, secretary-treasurer.

Synchronous Club Holds Monthly Meeting

At its regular monthly meeting held in the Edison Assembly Hall in Los Angeles on the evening of January 11 the Synchronous Club was entertained by a highly interesting and instructive address on "Commercial Aviation" by Colonel C. B. Worsnop, manager of the Mercury Aviation Company. Colonel Worsnop stated that commercial flying had already attained a position where the railroads are considering it as a possible competitor. Among the practical applications mentioned were the transporting of repair parts for machinery in emergencies, the carrying of important documents and letters, as well as preliminary surveys in mountainous country.

Salt Lake Jobbers Banquet Contractor-Dealers

The electrical jobbers of Salt Lake, consisting of the Capital Electric Company, the Intermountain Electric Company, Mine and Smelter Supply Company and the Western Electric Company, had as their guests the contractor-dealers of that city at a banquet at the Hotel Utah on the evening of January 5.

J. A. Kahn, general manager of the Capital Electric Company, was chairman, and C. B. Hawley, general manager of the Intermountain Electric Company, acted as toastmaster. About sixty representatives were present. Toasts were responded to as follows:

"The Electrical Jobber," C. H. Talmage, of the Western Electric Company.

"The Electrical Dealer," G. R. Randall, of the Salt Lake Electric Supply Company.

"The Central Station," P. M. Parry, of the Utah Power and Light Company.

"Cooperation," E. H. Eardley, of the Eardley Electric Company.

"Business Outlook for 1921," J. D. Nicholson, of the Mine & Smelter Supply Company.

"The Rocky Mountain Electrical Cooperative League," E. T. Millham, field secretary of the league.

California Contractor-Dealers Hold Quarterly Meeting

The annual midwinter quarterly meeting of the California State Association of Electrical Contractors and Dealers was held in Stockton on January 22. Practically every section of the state was represented, the bay cities delegation making the cruise by boat, fifty strong.

OH BOY! The Annual Midwinter Quarterly Meeting of the California State Association Electrical Contractors and Dealers — Stockton, January 22, 1921 (Saturday)

HOTEL STOCKTON: HEADQUARTERS—Make your reservations direct.

9:30 a. m.—Executive Committee Meeting. 1:30 p. m.—Adjustors' Meeting. 7 p. m.—Get-together Meeting.

SOME SUBJECTS FOR ACTION:—

The State Safety Code and Its Operation.
Your Responsibility in Preventing Carbon Industrial Illumination
(Illustrated Discussion by O. L. Johnson)
The State University Answering Queries for Electrical Men.
Some New Ideas by C. E. Brown
Lighting in On The Electrical Home Idea

Oh My! YES!

THE GREATEST WET SEASON

Annual R-sum-e of California's Electrical Industry, in this memorial number, along the seaside banks of the placid San Joaquin under the silly goodness of Capt. Kenney and Pilot H. H. Cavenaugh. Dr. W. Wheat, San Francisco, Friday evening, Jan. 21, 8 p. m. aboard ship. J. D. Peters, Notary. Name the Secretary (Code) 42,000 for reporter accommodations. Also a good time. Dr. Peters, Former Lumber and Freight Clerk Tank Steamers, will see to it. Island 5, server a full meeting.

Chas.—Bring along a bunch of your Turkish alfalfa—grass a short time.

Southland Boys—You for the wrongest and farmers for the "big exposure" on the fix was to "—Santa—Legendary Gorbitz. Chief Cam and the Clash-Annoying Bunch" will be on hand, along with Safety Fund Secretaries to report for mess.

San Luis Obispo—A real "atom up" for you on co-operation—both and Monterey and San Mateo Secretary—Get every Point a Day long enough so we have a look-in and on a real cruise.

Stockton—We'll see you Saturday 22nd

TWO BELLS! ONE BLAST! CAST OFF!

THE STATE ASSOCIATION,
By the Secretary.

A great many subjects of interest were taken up and discussed during the sessions of the executive committee, and at the members' meeting. The resignation of A. H. Elliot, for many years attorney for the state association, was accepted with regrets. John L. McNab was selected to succeed Mr. Elliot.

Preparations were outlined for the California visit of L. W. Davis, field representative for the National Association. Mr. Davis will spend February 8 and 9 in San Francisco, February 10 at Fresno, and February 11 and 12 at Los Angeles.

The Association's subscription of $3,000 to the Cooperative Campaign was renewed for the year 1921.

Sentiments were expressed that it was not for the best interests of the retail motor dealer for manufacturers to engage in general motor repairing; that the contractor-dealer should assist in the campaign for farm-lighting plants; and that the power companies should discontinue the practice of giving merchandise orders to employes.

The proposed Electrical Inspection bill was discussed and explained by R. L. Eltringham, executive secretary of the California Electrical Cooperative Campaign. It was the unanimous expression of the executive committee that the advisory committee be requested to place the services of Mr. Eltringham at the disposition of the industry to assist in insuring the passage of the bill.

Paul B. Kelly of the University of California explained the accounting course which is to be given by the Extension Division in connection with the Journal of Electricity and Western Industry.

A banquet was held in the evening at the Hotel Stockton at which more than one hundred and fifty were present.

Illuminating Engineer Speaks in Seattle

A special meeting of the Northwest Electrical Service League held at the Masonic Club rooms, Arcade Building, Seattle, on January 13 was addressed by O. L. Johnson, vice-president of the Illuminating Engineering Society and illuminating engineer for the Benjamin Electric Manufacturing Company. Mr. Johnson lectured on "The What and Why of Industrial Illumination," accompanying his remarks with special lantern slides illustrating various phases of industrial lighting. R. W. Clark of the Puget Sound Power and Light Company presided.

Water Power League Holds First Annual Meeting

The Water Power League of America held its first annual meeting in the Engineering Societies Building in New York on January 18 for the election of officers for the ensuing year. After the regular business had been transacted the meeting was thrown open to a general discussion of the power situation, both steam and hydroelectric. There was considerable discussion of recent propaganda concerning the national park reservations.

COMING CONVENTIONS

PACIFIC COAST SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION
Annual Convention—Del Monte, California, May 25-27, 1921

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Annual Convention—Salt Lake City, Utah, June 20-26, 1921

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Mid-Winter Convention—New York, Feb. 16-18, 1921

CONTRACTOR-DEALER MEETINGS, TO MEET L. W. DAVIS

Tacoma, Wash.	Feb. 3, 1921
Portland, Ore.	Feb. 4, 1921
San Francisco, Cal.	Feb. 7-9, 1921
Fresno, Cal.	Feb. 10, 1921
Los Angeles, Cal.	Feb. 11, 1921
Phoenix, Ariz.	Feb. 14, 1921

Electrical Inspection Bill Discussed by League

The proposed Electrical Inspection Bill, which is perhaps the most important piece of legislation of interest to the electrical industry coming before the Legislature, was the subject of discussion before the San Francisco Electrical Development League on January 17. The bill was submitted for deliberation to the league by the Industrial Accident Commission after a committee, of which S. J. Lisberger was chairman, had reviewed it and suggested amendments.

Messrs. Wolfin, Kimball and Pillsbury of the Industrial Accident Commission were present and explained the intent and wording of the bill to the members of the league. A report of the bill will be found in another section of this issue.

Wood Preservers Hold Convention in San Francisco

The American Wood Preservers' Association held a convention at the St. Francis Hotel on January 25, 26 and 27. Several papers were read on the general subject of wood preservation, covering treated timber, fir ties, creosoted wood silos, Douglas fir pipe staves, and pressure and non-pressure treatment of poles. C. H. Judson and E. W. Wismer of the Engineering Department of the Pacific Telephone and Telegraph Company presented a paper on "The Use of Creosoted Wood Conduit on the Pacific Coast."

The program was followed by a meeting of the National Association of Railroad Tie Producers, at which time many important features of the production were discussed.

Development League Hears Thelan

Members of the San Francisco Electrical Development League turned out in full force for the first meeting of the year, held on January 10, to hear Max Thelan, first president of the California Railroad Commission, tell of his impressions of Washington. Mr. Thelan was Surveyor of Contracts, Chief of the Purchase Branch and First Assistant to Major General George W. Goethals during his stay in Washington. His talk regarding the confusion resulting from the duplication of work, and the general inadequacy of the present departments of government to function as now constituted, showed that his stay in the capital had not impaired his ability to think clearly and constructively.

Importance of Advertising Is Emphasized at Luncheon

E. N. Britton, managing editor of Journal of Electricity and Western Industry, was the principal speaker at the weekly luncheon of the Electrical Club of Vancouver, B. C., on January 6. He emphasized the importance of co-operative advertising in the selling of electrical appliances.

The speaker congratulated the association on its energy in promoting the cooperative idea among the electrical men in Vancouver, and predicted that sooner or later there would be a cooperation of cooperative units all over the country for the mutual benefit of the members.

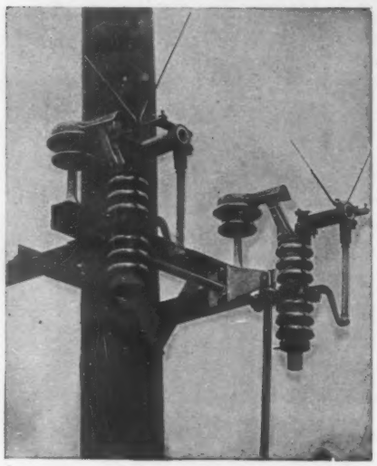
Dr. C. W. Prowd gave an interesting and technical talk on the history and use of the X-ray machine.

LATEST IN EVERYTHING ELECTRICAL

(New fixture joint and sockets which will insure ease of installation and greater convenience are latest improvements. Automatic control equipment and small capacity oil circuit breakers are of interest to the industries. Compact switching equipment for rural distribution systems combines several essentials.—The Editor.)

COMPACT SWITCHING EQUIPMENT FOR FARM LINE SERVICE

For both the protection and control of small outdoor distributing transformer installations which supply energy to farm extension lines and the



Combined fuse, lightning arrester and disconnecting switch for farm line service.

like, the Westinghouse Electric and Manufacturing Company has placed upon the market the type FL switch, which consists of a combined fuse, lightning arrester and disconnecting switch. The equipment may be mounted near the top of a line pole so that it is operated from the ground by means of an operating handle. This switch is adapted for applications requiring 24-hour service, but it is also suitable for applications such as grain elevators, mines, quarries, brickyards, etc., which are only operated periodically.

This combination switching equipment is of rugged construction and all metal parts exposed to the weather have a galvanized finish. The pillar type insulators are a one-piece porcelain.

HEAVY DUTY ELECTRIC BUFFER DEVELOPED

The U. S. Electrical Manufacturing Company have just recently completed the development of a new heavy duty Johnson Electric Buffer having an over all shaft extension of approximately six feet, so that two men can work on the machine at the same time without interfering with each other.

This buffer can be built in a number of different sizes for two or three phase alternating current, the five horsepower 3600 RPM being the most popular size.

Large deep grooved standard ball-bearings are used on these machines, one set of bearings being at the end of the housings with another set at the center of machine to prevent periodical vibration of the rotor.

Although in collaboration with the engineers of the Goodyear Tire and Rubber Company, in designing this machine as a buffer for pneumatic truck tires, the machine has proven ideal for many purposes such as, metal plating plants, radiator works, sheet metal works; in fact it is adaptable for use wherever a heavy duty buffer is required.

DRY AND STORAGE CELL TESTER

The Metric Appliance Company is manufacturing a so-called "Mac" Dry-Cell Tester and the "Mac" Storage-Cell Tester, which are especially characterized by their simplicity of construction and operation. They also announce the "Mac" Battery Connectors, which are made from No. 18 rubber-covered flexible wire, furnished in different lengths with brass terminals. These are conveniently used for connecting dry cells in series or multiple.

NEW FIXTURE JOINT

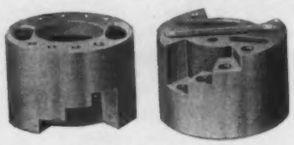
A new condulet fixture joint, Type UNJ, has been developed by Crouse-Hinds Company for supporting suspended type fixtures, and can be used with condulets in which the UNJ supports the fixture and the condulet provides a separate wiring chamber for the connections. As the UNJ has a universal joint the fixture is assured of a vertical position even if it is mounted on an inclined surface. The flexibility of this fixture joint will also prevent breaking at the point of suspension due to strains set up by the wind or by hitting the fixture with a step ladder or the like. The construction is such that the wires pass through the UNJ, consequently no wires are exposed at the fixture joint.

New fixture joint type UNJ which has been designed to insure vertical placing of fixtures and which has an advantage over the rigid fixture.

A NEW BRYANT SOCKET FOR LIGHTING REFLECTORS

To simplify the installation of sockets in reflectors as well as minimize the labor necessary for connecting circuit conductors thereto, the Bryant Electric Company have brought out a new medium base reflector socket which is designated by their catalog No. 4235.

This device is a single piece of ruggedly designed porcelain, with four



New reflector socket which permits focusing of lamp.

mounting levels or steps of ¼" each, providing opportunity to hold the lamp at four different focuses with reference to the reflector.

SMALL CAPACITY INDUSTRIAL OIL CIRCUIT BREAKERS

Type FP-10 oil circuit breaker, 50 amperes, 600 volts, for three and quarter-phase induction motors of 25 horsepower or less, is the subject of Bulletin No. 47419A, superseding Bulletin No. 47419, issued by the General Electric Company. This type of breaker is adaptable to a variety of industrial services and is made in several styles, with automatic and non-automatic control. The breaker can be mounted on wall, post or other flat vertical surface, or by means of suitable brackets or supports on machines driven by the motors which the breakers control.

Type FP-10 is strictly in line with "safety" principles. The interchangeability of parts, insuring quick repairs, as well as its reliability and simplicity are features worthy of mention.

The bulletin, which is profusely illustrated, includes dimension drawings as well as diagrams showing various methods of making connections.

AUTOMATIC STATION CONTROL EQUIPMENT

The many important economies in generation, control and distribution of electrical energy developed by automatic stations are presented in Bulletin No. 47730, issued by the General Electric Company, and entitled "Automatic Station Control Equipment."

The application of automatic station control equipment covers almost the entire field of electric generation and distribution. Over 100 automatic stations are now operating, and they have shown the automatic station to be successful in a wide variety of service.

A NEW TYPE OF PROJECTOR

The increase in the use of floodlighting for industrial purposes, particularly railroads and steel plants, has brought about the design of an entirely new projector which has been developed by Crouse-Hinds Company and described in their Bulletin No. 304A. This bulletin describes these in detail with pictures illustrating actual installations, and has full details of the new reflectors which have been developed as well.

Books and Bulletins

Bond Resistance Between Concrete and Steel

One of the latest publications of the Bureau of Standards is Technologic Paper No. 173, "Bond Resistance Between Concrete and Steel," a copy of which may be had by requesting the same from that bureau of the Department of Commerce.

This paper embodies the results of three investigations made by the Concrete Ship Section, Emergency Fleet Corporation, (1) to study the effect on bond resistance between concrete and steel of the applications of various anti-corrosive coatings of high tensile stress, and (2) to study the relative merits of different methods of anchoring the ends of stirrups to meet certain conditions which arise in concrete construction. All the paints tested (18) reduced the bond resistance. The length of lap for effective splicing was found to be greater than is generally supposed to be necessary. For anchorage of stirrups 270 degree loops were found to be more effective than the other types of anchorage tested.

Power Plant Library

Eight volumes by Palmer, Collins, Shepardson and Matthews; nearly three thousand pages, twelve hundred illustrations and diagrams, over two thousand questions and answers on steam and electricity; published by the McGraw-Hill Book Co. and for sale at the offices of Journal of Electricity and Western Industry, San Francisco.

In response to a great many requests from practical engineers, the McGraw-Hill Book Company has compiled and published The Power Plant Library. These eight books take up the following subjects clearly and concisely and often present in catechetic form: Practical Mathematics; Engine Running; Valve Setting; Boilers, Pipes, Piping and Pumps; Shafting, Pulleys, Belting, and Shaft Governors; Electricity; Steam Turbines and Refrigeration.

Laws on Electricity in Coal Mines

The Bureau of Mines has published Technical Paper 271, entitled "State Mining Laws on the Use of Electricity in and About Coal Mines" by L. C. Ilsley. An extensive list is given of the various publications available for free distribution which the bureau has published on the use of electricity in coal mines.

Miners' Safety and Health Almanac, 1921

This almanac is the third of a series published by the Bureau of Mines for the purpose of enlisting the cooperation of miners in improving health conditions and decreasing accidents in the mining industry. This is a novel but effective method of presenting the subject. There is a pertinent suggestion for every day in the year. Thus the suggestions are made to fit each particular season.

Among the topics which are briefly discussed are:

Underground Sanitation, Cheerfulness and Safety, Lead Poisoning, The Miners' Safety Lamp, and First Steps in Mine Rescue.

Instrument Transformers

The theory and construction of current and potential transformers are presented in a compact booklet which the Wagner Electric Manufacturing Company of St. Louis is distributing upon request.

Plan to Determine Ship Values

A plan to establish the basic principles controlling the establishment of ship values of United States Shipping Board vessels has been prepared in collaboration with Martin J. Gillen, former member of the War Industries Board of Organization and Special Assistant to Chairmen of the U. S. Shipping Board, John Barton Payne and Admiral W. S. Benson; L. L. Summers, former member of the War Industries Board Organization, and technical advisor to the Allied Peace Commission at Paris; and Guy D. Goff, present commissioner of the U. S. Shipping Board.

This plan in the form of a discussion and resolutions has been published in pamphlet form just as it was offered to the United States Shipping Board early in January.

Ad Aids for Universal Dealers

"Ad Aids for Universal Dealers" is the title of an attractive booklet put out by Landers, Frary & Clark, which is one of the forms of co-operating with their dealers adopted by this company. The booklet contains a variety of advertising material which should furnish the Universal dealer with many new ideas for window displays, newspaper advertising and street car cards. Copies of this will be furnished by any of the Universal distributers or it may be obtained from the home office at New Britain, Conn.

Connecting Induction Motors

By A. M. Dudley, manager Automotive Engineering Department, Westinghouse Electric and Manufacturing Co.; 252 pages 6x9, 289 illustrations. Published by McGraw-Hill Book Co. of New York City, and for sale by Journal of Electricity and Western Industry, San Francisco.

The practical application of a designing engineer's experience to the problems of operating engineers, armature winders and repair men. The book discusses practical questions arising in winding and connecting alternating motors and includes ninety-two standard group and wave diagrams. The material of the book appeared as a series of articles in Power, where it attracted much attention. The contents include: What the winding of an induction motor accomplishes; the rotating magnetic field; types of windings; chorded windings or the effect of coil throw on the magnetic field; reconnecting an old winding for new conditions; and many other headings that will prove of value.

New Diesel Engine Catalogue

The Western Machinery Company has issued a new catalogue on Western Diesel engines of both the stationary and marine type that are manufactured by this company. The catalogue is well supplied with illustrations and copies of blueprints showing the internal construction of the engines, and contains photographs of some of the notable installations made by the company where the Diesel engine has proven its effectiveness.

Fuel Economy in Boiler Rooms

By A. R. Mauajer and Charles H. Bromley; 308 pages, 5½x8. Published by McGraw-Hill Book Co., New York City, and for sale by Journal of Electricity and Western Industry, San Francisco.

The best boiler room practice in the best engineered power plants, written in simple, understandable language from the point of view of the man actually responsible for fuel saving. The book is full of illustrations, tables, charts, and useful data which is of great value to the man in the boiler room.

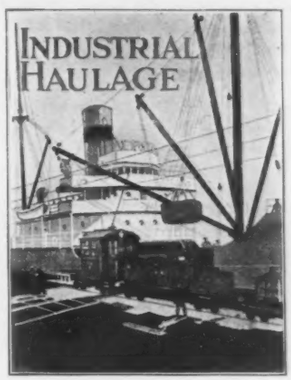
New Publication Is Started in Fresno

A new weekly newspaper, the Co-operative Californian, has recently started publication in Fresno, Cal., "to tell the world why the competitive system of selling is a failure wherever it is followed, and why the producers can never make a success by that method of disposing of the products of their industry."

One of the principal contributors to the first issue is A. E. Wishon, general manager of the San Joaquin Light and Power Corporation, who is the author of the "self-interest" appeal in business. Mr. Wishon gives an elaborate explanation of his ideas and demonstrates that the development of hydroelectric power is of direct benefit to all industries.

Industrial Haulage

Under the title "Industrial Haulage," the General Electric Company has issued an illustrated bulletin in which is described some of the most representative types of electric locomotives. The list of industries covered comprises



This booklet presents an application of electricity which will have a marked effect on leading Western industries.

shipyards, steel plants, by-product coke plants, ore docks, chemical plants, brick yards, stone quarries, cement plants, docks and warehouses, power house, ash handling and manufacturing plants in general.

Many advantages are claimed for the electric locomotive in factory transportation, the more important of which, as outlined in this bulletin, are that it consumes power only when in actual operation, is ready for use at all times, can be operated by one man of ordinary intelligence, possesses an easy and perfect system of control and can be run inside a building where the fire risk from a steam locomotive would be prohibitive.

NEW ELECTRICAL DEVELOPMENTS

(The establishment of new enterprises, and the enlargement of established ones seems to be the feature of the news of the Northwest. The proposed extension of distributing systems characterizes the Pacific Central district, due to the building of new projects. A new railroad in Utah is the feature of the Intermountain news.—The Editor.)

THE PACIFIC NORTHWEST

ASTORIA, ORE.—The Altoona Packing Company has plans well under way, and construction started, on a modern cold storage plant in Astoria.

PRINEVILLE, ORE.—The Cumberland-Wyoming Oil & Gas Company, with headquarters at Prineville, has been incorporated with a capital stock of $500,000.

PENDLETON, ORE.—A meeting of representatives of the towns of this district was held in this city on January 26, for the purpose of taking preliminary steps with a view of the hydro-electric development of Umatilla Rapids.

PORTLAND, ORE.—Building activities for fiscal year of 1920, just ended, exceeded by $2,100,000 the total sum expended during the preceding year. Over 10,000 building permits were issued during 1920, a gain of 1200 for the year.

PORTLAND, ORE.—The people of Union High School District No. 3, comprising ten school districts in the vicinity of Milton-Freewater, have voted to expend $150,000 to build a new high school, and $50,000 for the grounds and equipment.

LA GRANDE, ORE.—The city of La Grande has filed with the state engineer an application for authority to appropriate 200 second feet of water from the Grand Ronde river for an additional municipal supply at the present pumping plant.

SALEM, ORE.—A new irrigation district, known as the Patterson district, has been organized in Klamath county, near Merrill, and has submitted its plans to the state engineering department for approval. The district covers about 2000 acres.

PORTLAND, ORE.—The Northwest Blower Kiln Company of Portland has received a contract for the construction of 30 lumber dry kilns for the McCloud River Lumber Company, at McCloud, Cal., involving the expenditure of approximately $300,000.

SPOKANE, WASH.—The Washington Water Power Company recently put one-man car operation on their Hillyard line, the cars all of the large 200 type. This completes the change over to one-man operation of all cars of the W. W. P. Co. system.

PORTLAND, ORE.—The Big Bear Soap Company is a new industry recently established in Portland. A. F. Baker, proprietor and manager, is operating a factory in San Jose, Cal., to supply the trade in that district, and his Portland factory is designed to meet the demand for his product in the Northwest.

KLAMATH FALLS, ORE.—J. O. Goldthwaite reports the installation of the first unit of the 1200-kw. power plant which will change the Modoc lumber mill from a steam to an electrically driven plant. It is also reported that a new mill with two band and a gang saw with a capacity of 50,000,000 cubic feet will be built.

SALEM, ORE.—A total of 86,368 acres of desert land in Oregon have been reclaimed, settled, placed in a productive state and entered upon the tax rolls of the state during the past two years, according to the report of the state desert land board. The report shows that the cost to the state for this reclamation work has been 51 cents per acre.

PORTLAND, ORE.—The commission of public docks, in ordering improvements for Terminal No. 4, has authorized a lighting system for vessels so that they may be supplied with electric current from the dock and will not be required to keep their dynamos running.

EVERETT, WASH.—The Occident Rubber Company, with its new plant at Beverly Park practically completed, expects to get under way manufacturing within 60 days. Rubber soles and heels will be the first product placed on the market by the new company. Solid automobile and truck tires will come next, with rubber mats and belts to follow.

TACOMA, WASH.—By order of the Public Service Commission, the Puget Sound Electric Railway is permitted to discontinue service on the old Puyallup line, from Summit to Fruitland. It is stated that revenues on the line, during the three months' trial period ending Dec. 31st, to be only $141.11, as against expenses of $499.10, exclusive of depreciation.

SALEM, ORE.—The Medford irrigation district today filed application with the state engineer for the certification of bonds in the sum of $1,200,000. The money derived from the sale of the bonds will be used in completing the southern Oregon project. The district comprises approximately 10,000 acres. Future construction will include a continuation of the ditches of the Rogue River Canal Company.

CENTRALIA, WASH.—A portion of the plant of the Tennent Steel Castings Company of Tacoma, Wash., will be moved to Centralia, Wash., by the end of February. The firm has contracted to sell a majority of its production to the Kane Pneumatic Absorber Company of Centralia, and will manufacture the castings desired by the Absorber Company in that city. The company will also manufacture castings and conveyor chains for lumber mills. The Centralia plant will employ about 50 persons.

THE PACIFIC CENTRAL DISTRICT

MADERA, CAL.—The San Joaquin Light & Power Corporation is continuing to extend its services to pumping plants in the county. These extensions have been made possible because of new power supplies from the Kerckhoff dam.

GREENVILLE, CAL.—The Great Western Power Company has recently doubled its capacity in this county with the re-insulation of its electric lines, which will now carry a voltage of 44,000-hp. With the coming of spring, 300 poles between Butt Valley and Walker Mine will be replaced.

BERKELEY, CAL.—The American Insulex company, a local corporation, has started production of heat-insulating material and fireproof paint in the first unit of its manufacturing plant and is planning the erection of a plant in Berkeley, according to an announcement made recently.

EUREKA, CAL.—A large whaling plant and fertilizer works have begun operations at Trinidad. Indications are that an additional industry will be established there in the near future; that of an electric smelter for the production of aluminum and the treatment of other metallic ores by electro-chemical processes.

MODESTO, CAL.—With its five-year franchise grant ratified by a vote of electors of Modesto, the Pacific Telephone and Telegraph Company announced that the work of building a new exchange and headquarters for this district would proceed forthwith. It is understood that the new 3-story building will cost over $100,000.

BAY POINT, CAL.—The Bay Point Light and Power Company is erecting a new sub-station to supply the increasing load of the Bay Point Box and Manufacturing Company. Three 50-kva. transformers have arrived and are in place.

SACRAMENTO, CAL.—A contract for the construction of the water portion of Sacramento's proposed filtration plant has been awarded to Coast Construction Company of San Francisco. The Bank of Italy of San Francisco will finance the work.

NEVADA CITY, CAL.—Sydney B. Smith, well known mining man, has taken over a bond and lease to develop the old You Bet mining property of 1300 acres. The hydraulic method has been selected as the best method of developing the property.

SAN FRANCISCO, CAL.—Considered by paper pulp manufacturers as a means of relieving paper shortage conditions in the future, the successful making of cardboard from rice hulls was announced yesterday by W. P. Taylor, son of S. P. Taylor, California's first paper manufacturer. Taylor announced that two mills will be built in San Francisco shortly to manufacture pulp for cardboard from rice hulls.

REDDING, CAL.—The first cut in miners' wages in the Shasta copper belt is announced at Winthrop, or Bully Hill, where the Shasta Zinc and Copper Company has posted notices that a reduction will go into effect on February 1. Miners' wages will be cut from $5 to $4.25; muckers, from $4.50 to $3.75; carpenters, from $7 to $6; plumbers, from $8 to $6.50, and other mechanics and laborers in proportion.

FRESNO, CAL.—The extensive oil holdings of the Southern Pacific Railroad Company in Fresno, Kings and Tulare counties, representing a nominal valuation of nearly $4,000,000, have been transferred to a new holding corporation known as the Pacific Oil Company. The transfer, which was filed here recently, followed close on the heels of the announcement of a voluntary decision to divorce the oil interests of the company from its land activities.

MERCED, CAL.—The offer of $1,750,000 made by the directors of the Merced irrigation district to the Crocker-Huffman Land and Water Co. for the latter's canal system has been refused. Some time ago the company offered to sell its plant for $4,000,000, but the irrigationists declined to consider the offer, and at a subsequent conference the latter submitted their proposition. The next move in the negotiations will be watched with interest throughout the San Joaquin valley.

FRESNO, CAL.—The plans for the $200,000 office building to be built jointly by the California Peach Growers and Associated Raisin Co. at Fresno, are being prepared by Glass and Butner, Fresno and San Francisco, architects. The same architects are also preparing plans for a $250,000 packing house for the California Peach Growers. The engineering and mechanical plans are being prepared by Hunter and Hudson of San Francisco. Construction is to be of reinforced concrete.

DUNSMUIR, CAL.—The new street lighting system of this city is being installed by the California Power Company.

REDDING, CAL.—The Happy Valley irrigation district has voted $150,000 in bonds running from seven to seventeen years. There were only two votes against the bonds. The district, which embraces 18,000 acres of the best fruit land in the county, is already bonded for $615,000. The additional issue was needed to complete the system.

WILLOWS, CAL.—The local office of the Pacific Gas and Electric Company was advised that an appropriation of $19,000 has been made for improving the water system of the company in this city and that work on the improvement will begin very shortly. This sum will be expended on a new steel water tower which will replace the present obsolete and inadequate tank.

SAN RAFAEL, CAL.—Mayor George F. Rodden has been authorized by the city council to name a commission to make a survey and render a report as to the feasibility of a plan by which the municipality may install its own plant for the distribution to consumers of electric current. By this plan the current would be purchased by the city from the Pacific Gas and Electric Company and retailed to the city itself and private consumers.

SACRAMENTO, CAL.—The judgment of the Mendocino county superior court, which awarded a number of farmers $105,600 damages for land fronting on Clear Lake, Lake county, inundated by the Yolo Water, Light and Power Company, was reversed here by the court of appeals. The case was begun in 1912 when the power company brought suit to condemn 72 acres of land so that surplus water might be stored behind the company's dam.

DELANO, CAL.—Private individuals have made application for use of part of the natural flow of the north fork of the Stanislaus river. It is contemplated to erect a power plant at the headwaters of the river to develop about 9600-hp., involving an expenditure of $2,000,000. Permission to store 31,933 acre feet of water from the Stanislaus between November and June is applied for, and the continuous use of 130 cu. ft. per sec. of the natural flow is also sought.

FRESNO, CAL.—Approval of the state bond commission for the acquisition of the property of the Fresno Canal and Land Company by the Fresno irrigation district has been given, thus removing the last obstacle in the way of acquiring the irrigation system in this district. An election will be called early in February, when it is proposed to vote $2,000,000 in bonds to acquire the property. The proposal carries with it not only the purchase of the canal system but valuable water rights in Kings river.

OROVILLE, CAL.—At a conference between representatives of Thermalito and the proposed Table Mountain irrigation district held in Oroville, details were discussed relative to the plan for the construction of an impounding reservoir in Concow valley to irrigate lands lying in the Thermalito and Table Mountain sections. The plan as proposed calls for the construction of a dam with the Pacific Gas & Electric Company. This company would use the dam for the manufacture of power. After it had been used for power it would be turned over to the district for irrigation purposes.

THE PACIFIC SOUTHWEST

LONG BEACH, CAL.—W. J. Burgin has contracted to erect an addition to the building occupied by the Long Beach Hardware Company, for the Lantz Electric Company.

LONG BEACH, CAL.—V. E. Clark, representing the American Aircraft Commerce Corporation, has proposed to the Chamber of Commerce to build an airplane factory, flying school and field, also a balloon and dirigible manufacturing plant, with an electrolytic plant for the manufacture of hydrogen for balloons.

SANTA FE, N. M.—Announcement has been made here of the plans to erect a building estimated to cost from $800,000 to $1,000,000, for use as the factory of the Cannon Ball Motor Company of Texico, N. M.

FILLMORE, CAL.—The Sespe Light and Power Company have announced the intention of erecting a series of dams on the Sespe river for the development of power and for the conservation of water for irrigation.

EL PASO, TEXAS.—Louis C. Hill, of Los Angeles, has been appointed consulting engineer for the Water Users' Association in a proposed project to harness the waters of the Elephant Butte Dam for power for El Paso.

DOUGLAS, ARIZ.—A party of engineers headed by Nicholas Duran of the City of Mexico are in the field locating the site of two dams to be constructed for the irrigation and hydroelectric projects of the Sonora and San Miguel rivers. One million acres of land are to be reclaimed.

LOS ANGELES, CAL.—A permit has been issued for the erection of a $1,000,000 unit to be added to the Los Angeles Union Terminal. The new building is to be 600 feet long with a frontage of 100 feet and a floor space of 450,000 square feet. The building will be completed in June.

DOUGLAS, ARIZ.—Announcement was made here Saturday that the Apache Powder Company will erect a fuming acid plant at the Calumet & Arizona smelter here. The Apache Powder Company's plant, building of which has been under way for some time, is located about seven miles from Benson, this county.

PASADENA, CAL.—As the first step in a water supply plan the city of Pasadena has filed upon the waters which come from Little Bear Lake, the Mojave river and Holcomb, Deep and Grass creeks, all in the San Bernardino. The filing is upon 80,000 acre-feet from those sources. It was made with the State Water Commission.

EL CENTRO, CAL.—An immediate expenditure of approximately $49,000 by the Holton Power Company for the reconstruction of the El Centro lighting system is being planned by the company, according to an announcement given out by E. W. Judy, district manager of the Southern Sierras Power Company, owners of the local distributing company.

SANTA PAULA, CAL.—Southern California Edison Company applied to the State Railroad Commission for a certificate declaring that public convenience and necessity require the exercise by the company of its franchise to construct, operate and maintain an electric distributing and transmission system in the city of Santa Paula, Ventura county. The franchise was granted on December 6, 1920, by the city trustees of Santa Paula and is to run for 50 years.

THE INTER-MOUNTAIN DISTRICT

MALTA, MONT.—The Milk River irrigation project will receive an appropriation of $1,017,000, if the recommendation of the house appropriations committee prevails in congress. The Huntly project is slated for $198,000 and the Lower Yellowstone for $240,000, according to word received here.

ELKO, NEV.—By a vote of 115 to 90 the citizens of Elko have ratified the proposition to issue bonds to the amount of $180,000, of which $150,000 is to be used for purchase of the Elko water system from W. T. Smith. The remaining $30,000 is to be used in developing more water for the city.

PROVO, UTAH.—The Utah Railway Company, which handles coal from the Carbon county coal fields, is building new shops at Provo. A new substation, of 225-kva. capacity, is being built to take care of their electrical service to their shops. Their initial requirements will be about 150-hp.

GREAT FALLS, MONT.—Eighty-five thousand acres more in the Sun river irrigation project will be watered if the recommendation of the house appropriations commission for $787,000 is enacted by congress. George Stanford, manager of the Sun river project, says the money will be used in building the Beaver Creek dam.

SALT LAKE CITY, UTAH.—Preliminary surveys have been completed for the proposed Salt Lake and Denver railroad into the Uintah basin. The survey calls for the construction of a road 200 miles in length, reaching into the Rangely oil fields, some thirty miles east of Watson, and twenty miles into the state of Colorado.

SALT LAKE CITY, UTAH.—L. E. Cluff, of Salt Lake, has filed an application with the state engineer of Utah for fifteen second feet of water in Fish Creek, in Piute county. It is set forth that this is desired for the purpose of developing 1200-hp. for electric light and power, to be marketed in Sevier, Sanpete, Piute, Garfield, Millard, Beaver and Iron counties.

PARK CITY, UTAH.—Summit county has signed a street lighting agreement with the Utah Power & Light Company covering county highway lighting between the towns of Coalville and Marion. The initial installation calls for nineteen lamps varying in size from 100-cp. to 490-cp. Additional units will be installed later between various other towns in the county.

EUREKA, UTAH.—The Tintic Standard mine, in preparation for the sinking of another large working shaft, recently placed an order for new machinery, including one of the largest compressors that has ever been shipped into the state of Utah for mine use. This compressor will have a capacity of 3000 cubic feet of free air per minute, and, like the other machinery, will be electrically driven.

SALT LAKE CITY, UTAH.—Contract has been finally executed between the City of Salt Lake and the Utah Power & Light Company, covering the installation and maintenance of the Broadway, State street and Fourth South street lighting systems. The new lighting system will extend on State street from South Temple to Fourth South, on Broadway from West Temple to Second East, and on Fourth South from Main to State street.

RENO, NEV.—Surveys of two mammoth reservoir sites below the rim of Lake Tahoe, the completion of either of which would mean the Nevada irrigationists were no longer dependent upon storage in Lake Tahoe for their summer supply of water, have been made by the United States Reclamation Service. The completion of one of these reservoirs would mean the end of a controversy between Truckee river power interests and Nevada farms on the one side and California interests at Lake Tahoe.

DENVER, COL.—A project that is going to have a far-reaching influence on the smelting situation in Colorado is being worked out in connection with a power enterprise on the Gunnison river above Lake City, in Hinsdale county. It is proposed to establish at and below Lake San Christobal a power plant that generates from 8,000 to 10,000 minimum horsepower. If electrical smelting is worked out successfully in Hinsdale, it will follow that the plan will be installed in other San Juan districts and throughout the state.

THE McGRAW-HILL BUILDING

An error in the caption under the airplane view of the McGraw-Hill Building on page 109 gives the height of the building as ten stories. The building has twelve stories and a mezzanine.

Introducing Salvage

Some are born important, some achieve importance, and some have importance thrust upon them. This page is in the third class. In an intellectual contemporary (which we read for recreation when exhausted by our own humor) we have just met the following remark: "The saving of waste material incident to production and manufacture is being recognized as an important economic duty."

Now as editor of this page we are chiefly concerned with rescuing the waste material incident to the production and manufacture of the remaining pages of this periodical. Therefore we are an Important Economic Duty.

The idea struck us—struck us so forcibly, in fact, that we lost our balance and began to write an editorial. This is it. Also we did what a good many people (mainly ladies) do when they lose their balance: we changed our name. That is it at the top of the page, with the picture of the acquisitive gentleman performing an Important Economic Duty.

Now it is not often we have an Idea. As far as possible we have tried to keep Ideas out of this page, and we—and other people—consider that we have succeeded remarkably well. But an Important Economic Duty has a position to keep up, and one Idea couldn't be helped this time. However, it is not likely to occur again for a long time.

* * *

Industrial Gossip

(Special by leased wire from the Bureau of Useless Information)

It is reported that a new soap factory appeared in the West last month immediately following a plea for a cleaner local government.

Everything grows large out west. Some of our new office buildings are said to be so spacious that the firms are providing roller skates for use along the corridors.

The butter market is reported soft as usual, in spite of the cold weather.

We hear that the site has been chosen for a factory to be devoted exclusively to the manufacture of antiques.

The thumb tack industry will hold its 188th annual convention this year. Many penetrating speakers are on the program, and many interesting points will be impressed upon those present.

* * *

For those who aspire to be technical writers we reprint the following remarks of a prominent mining man who was asked how he would train a technical writer:

"First of all I would catch him young and feed him on alphabetical crackers to insure that he became a man of letters. Then I would give him a careful diet of raw bull to strengthen his nerve—the one most essential thing in technical writing.

"I would teach him that the other man in the same line of work is always wrong: can't possibly be right. I would attempt to teach him that clearness is fatal to any technical writer. I would drill into him daily, 'Kid, obscure your meaning, and you will become famous. Then it will give you a convenient loophole to escape if you ever have to.'

"If you want to throw a few additional smoke screens into the article, which is always desirable, punctuate it with stars, crosses, and other mysterious marks, the harder to understand the better. Then have a number of footnotes that correspond, but mean nothing. Be sure that you refer as authority to some society that you defy your reader to find out anything about, such as 'Flannigan in the May, 1852, proceedings of Erin-Go-Bragh.'

"Always quarrel with your scientific brother in a dignified manner. Begin with, 'May I have the honor to explain.' This is an important accomplishment in technical writing. A fully equipped technical writer is one who can tell a man he is a damn fool in language that leaves him flattered.

"And please remember as a technical writer that nothing is ever perfect. If you are in a great art gallery and the simple-minded folk are admiring the 'Venus de Milo' in their crude, enthusiastic way, remember your training and take issue with the work. Suggest that it is not true to nature because it does not have one or two warts on the feet.

"I almost forgot to say that brevity, being the soul of wit, has no place in a technical article."

* * *

ELECTRICAL HYBRIDS—VII

The Electrical Dry Cellk

The Dry Cellk is a sly cellk;
His appearance is bound to deceive;
He looks simple as glue,
But the things he can do
Are such as you'd hardly believe.

The deep guile in his sweet smile
He never can perfectly hide;
Though his head's like a box
It would give you some shocks
If you knew what went on inside.

His downcast eye is the means whereby
He works the simplicity trick;
But in spite of his face
He conceals in the case
Labeled "dry" quite a vigorous kick.

Where To Find It In The West

A partial list of manufacturers of electrical and industrial apparatus, equipment, machinery and supplies, together with their Western Distributing Outlets

The editors and business staff of Journal of Electricity and Western Industry are frequently asked "Who represents So-and-So?" or "Has John Doe & Company a Western branch?" The following list is an attempt on the part of our service department to answer such questions in advance.

This guide is to be made a permanent semi-annual feature of Journal of Electricity and Western Industry, so we will appreciate suggestions regarding additions or possible inaccuracies which may not have reached us at the time of going to press. The list is in two sections, viz.: first, the names of manufacturers and their Western branches or agents; second, the Western distributors and the products or lines they represent. It embraces advertisers as well as non-advertisers. If errors or omissions have been made, it is solely because of incomplete information. For more complete data refer to our "Where to Buy" directory in the advertising section.

List of Manufacturers

ACME APPARATUS CO.
Arno A. Kluge, Los Angeles.
Western Radio Elec. Co., Los Angeles.
Wireless Shop, Los Angeles.
Leo J. Meyberg, San Francisco.

ACME WIRE COMPANY.
Baker-Joslyn Co., San Francisco and Los Angeles.

AJAX ELEC. SPECIALTY CO.
Clarence Denny, Seattle.
A. C. Riddell, Los Angeles and San Francisco.
Kiser, Askerman, Gardner Co., Salt Lake City.

ALADDIN MFG. CO.
Western Agencies Co., San Francisco, Los Angeles and Seattle.

ALLEN BRADLEY CO.
Allen Bradley Co., Denver, San Francisco, Los Angeles, Seattle.

ALLIS-CHALMERS MANUFACTURING CO.
Allis-Chalmers Mfg. Co., San Francisco, Los Angeles, Portland, Seattle, Salt Lake City, Phoenix, Spokane, Denver, Vancouver, Butte

ALLMUR MFG. CO.
Pacific Sales Co., San Francisco.

ALTORFER BROTHERS CO.
Altorfer Brothers Co., San Francisco.

ALUMINUM CO. OF AMERICA
Aluminum Co. of America, San Francisco.

AMERICAN BLOWER CO.
Anaconda Copper Mining Co., Butte.
American Blower Co., Seattle and Salt Lake City.
R. B. Guernsey Co., Los Angeles and San Francisco.
Howard H. Fielding, Denver.
Taylor Engineering Co., Vancouver, B. C.

AMERICAN CIRCULAR LOOM COMPANY.
Clapp & La Moree, Los Angeles.
L. E. Sperry, San Francisco.

AMERICAN CONDUIT CO.
Western Elec. Co., Inc., San Francisco, Oakland, Seattle, Los Angeles, Portland, Tacoma.

AMERICAN ELEC. HEATER CO.
R. G. Ellis, San Francisco.
Geo. H. Ostiguy, Seattle.

AMERICAN INSULATED WIRE & CABLE CO.
Baker-Joslyn Co., San Francisco, Los Angeles and Seattle.

AMERICAN LINE MATERIALS CO.
Tide Water Cross arm & Conduit Co., Tacoma.

AMERICAN PULLEY CO.
American Pulley Co., Seattle, San Francisco, Los Angeles.

AMERICAN VULCANIZED FIBRE CO.
Western Elec. Co., San Francisco, Los Angeles, Oakland, Portland, Seattle and Tacoma.

ANACONDA COPPER MINING COMPANY
Pacific States Electric Co., San Francisco, Los Angeles, Portland, Spokane, Seattle.

APEX APPLIANCE CO.
Apex Appliance Co., Los Angeles, Oakland.
J. C. English Co., Portland.

APEX ELECTRICAL DISTRIBUTING CO.
Illinois Elec. Co., Los Angeles.

APPLETON ELEC. CO.
Keeler White Co., San Francisco.

ARMCO IRON CULVERT & FLUME MFRS. ASS'N.
American Rolling Mills Co., San Francisco.

ARNOLD ELECTRIC CO.
The Poole Electric Co., Seattle.
L. & M. Sales Co., Los Angeles.

ARROW ELECTRIC CO.
Arrow Electric Co., San Francisco.

ATLAS CAR & MFG. CO., THE
Coast Equipment Co., San Francisco.

M. B. AUSTIN & CO.
George A. Gray Co., San Francisco.
J. G. Pomeroy, Los Angeles.

THE AUTOMATIC RECLOSING CIRCUIT BREAKER CO.
Ambler & Reter, Salt Lake City
C. F. Henderson, San Francisco

BARNES & IRVING
Elec. Materials Co., San Francisco

BATES EXPANDED STEEL TRUSS CO.
Electric Materials Co., San Francisco.

BELDEN MFG. CO.
Keeler, White Co., San Francisco.

BEST ELECTRIC CORP.
Western Agencies Co., San Francisco.

BESTOV MANUFACTURING CO.
Western Agencies Co., San Francisco.

BETHLEHEM STEEL COMPANY.
Bethlehem Steel Co., San Francisco.

BIRTMAN ELECTRIC COMPANY.
H. J. Gute & Co., San Francisco.

BLACK & DECKER MFG. CO., THE
Black & Decker Mfg. Co., San Francisco.

BLAW KNOX CO.
Blaw Knox Co., San Francisco.
J. T. Crowe & Co., Seattle.
The J. McCrahen Co., Portland.
Hoflus-Ferris Equip. Co., Spokane.
The Brown Bevis Co., Los Angeles
Pratt Gilbert Co., Phoenix.

BOOTH ELECTRIC FURNACE CO., THE
Curtis Engineering Co., Los Angeles.

BRYANT ELEC. CO.
Bryant Elec. Co., San Francisco.
Illinois Elec. Co., Los Angeles.

BUSSMANN MANUFACTURING CO.
Keeler, White Co., San Francisco.

A. S. CAMERON STEAM PUMP WORKS.
A. S. Cameron Steam Pump Works, Los Angeles, Salt Lake, San Francisco, Seattle.
Ingersoll-Rand Co., Butte.
Hendrie & Bolthoff, M. & S. Co., Denver.
The Stearns Rogers Mfg. Co., Denver.

CARLISLE & FINCH COMPANY, THE
Herzog Electric & Engineering Co., San Francisco.
Beebe Co., Portland.
Pacific Net & Twine Co., Seattle.

CASEY-SHELDON-FOSTER.
Casey-Sheldon-Foster, Inc., Portland, Oakland.

CENTURY ELECTRIC COMPANY
Century Electric Co., San Francisco, Los Angeles, Portland, Seattle, Salt Lake City, Denver.

CHAIN BELT COMPANY.
Hofius-Ferris Equipment Co., Spokane.
Washington Machinery & Supply Co., Seattle.
Loggers & Contractors Machinery Co., Portland.
Meese & Gottfried Co., Los Angeles, San Francisco, Seattle, Portland.
A. F. George Co., Inc., Los Angeles.
Landes & Company, Salt Lake City.

CHANDEYSSON ELEC. CO.
American Mfg. & Exp. Corp., Seattle.

E. T. CHAPIN CO.
E. T. Chapin Co., Salt Lake.

CHARTER OAK STOVE & RANGE CO.
Hexter & Co., Portland.
Hollen-Mason Hdwe. Co., Spokane.
Sprajins & Co., Salt Lake.
R. F. McKesson, San Francisco.

CHICAGO FUSE MFG. CO.
Illinois Elec. Co., Los Angeles.

CHICAGO INSULATED WIRE & MFG. CO.
Fobes Supply Co., Portland, Seattle and San Francisco.

CHICAGO MICA CO.
Strimple & Cox, Seattle.
Clapp & La Moree, Los Angeles.

CHICAGO PNEUMATIC TOOL COMPANY.
Chicago Pneumatic Tool Co., Los Angeles, San Francisco, Seattle.
F. C. Richmond Machinery Co., Salt Lake.

CHICAGO SOLDER CO.
Louis J. Ziesel Co., San Francisco.

CHISHOLM-MOORE MFG. CO., THE
The Republic Supply Co., Los Angeles.
Manning, Maxwell & Moore, Inc., San Francisco.
Republic Supply Co., San Francisco.
Berger & Carter Co., San Francisco.
Pacific Tool & Supply Co., San Francisco.
Hendrie & Bolthoff Mfg. & Supply Co., Denver.
Talbot, Hubbard Co., Phoenix.
Marshall-Wells Co., Portland.
Inter-Mountain Electric Co., Salt Lake.
Berger & Carter Co., Seattle.
Clyde Equipment Co., The, Seattle.
Manning, Maxwell & Moore, Inc., Seattle.
Marshall-Wells Co., Seattle.
Marshall-Wells Co., Spokane.

CLEMENTS MFG. CO.
Spencer F. E., Los Angeles.
San Francisco Compressed Air Cleaning Co., San Francisco.
Ray Bentley, Portland.
Clements Mfg. Co., Seattle.

CLEVELAND ELECTRIC MOTOR CO.
John T. Biel & Co., Los Angeles.

CLIPPER BELT LACER COMPANY.
Hendrie & Bolthoff Mfg. & Supply Co., Denver.
Galigher Machinery Company, Salt Lake.
Pacific Mill & Mine Supply Co., Los Angeles, San Francisco.
Graton & Knight Mfg. Company, Portland.
Pacific Asbestos & Supply Co., Portland.
Atlas Packing & Rubber Co., Seattle.
Seattle Belting & Supply Co., Seattle.
W. H. Worden Company, Inc., Seattle.
Washington Machry & Supply Co., Spokane.

COFFIELD WASHER CO.
Coffield Washer Co., Denver.
Doerr-Mitchell Elec. Co., Spokane.
Home Elec. Co., Tacoma.
Seattle Elec'l Supply Co., Seattle.
A. A. Wilson, Los Angeles.

COLUMBIAN ROPE COMPANY.
American Paper Co., Seattle.
Baker, Hamilton & Pacific Co., San Francisco.
Blake, McFall Co., Portland.
Harper & Reynolds, Los Angeles.
Spokane Paper & Stationery Co., Spokane.

CONDIT ELEC'L MFG. CO.
H. B. Squires Co., Los Angeles, San Francisco and Seattle.

CONNECTICUT TELEPHONE & ELEC. CO.
Myers and Schwartz, San Francisco.

CONTINENTAL FIBRE CO.
Continental Fibre Co., San Francisco, Los Angeles.

CONVEYORS CORPORATION OF AMERICA.
Stearns-Roger Mfg. Co., Denver.
F. C. Richmond Machinery Company, Salt Lake City.
Hallidie Machinery Company, Seattle, Wash.

CRANE CO.
Crane Co., Los Angeles, Portland, Salt Lake City, San Francisco, Seattle and Spokane.

CRESCENT INSULATED WIRE & CABLE CO., INC.
Geo. A. Gray Co., San Francisco.
North Coast Electric Co., Seattle.
Graham-Reynolds Elec. Co., Los Angeles.
North Coast Elec. Co., Portland.
New England Elec. Co., Denver.

CROCKER-WHEELER CO.
Crocker-Wheeler Co., San Francisco.

CROUSE-HINDS CO.
Western Electric Co., Seattle, Spokane, Portland, San Francisco, Los Angeles.

CUTLER-HAMMER CO.
Cutler-Hammer Co., San Francisco, Los Angeles, Seattle.

DAVIS SEWING MACHINE CO.
Alexander & Lavenson Electrical Supply Co., San Francisco.
Listenwalter & Gough, Inc., Los Angeles.
Northwest Appliance Co., Everett, Wash.
Culbertson-Grotte-Rankin, Spokane.

D. & W. FUSE WORKS OF GENERAL ELEC. CO.
General Elec. Co., San Francisco, Los Angeles, Portland, Seattle, Salt Lake City, Denver, Butte, Phoenix.

DELCO LIGHT CO.
deJongh & Cochran, San Francisco.
Modern Appliance Co., Seattle.
Modern Utilities, Ltd., Vancouver.

DELTA STAR ELECTRIC CO.
Delta Star Elec. Co., Salt Lake City.
Delta Star Elec. Co., Seattle
Delta Star Elec. Co., Denver.

DENVER ENGINEERING WORKS CO.
Salt Lake Hardware Co., Salt Lake.

DETROIT TWIST DRILL CO.
Lippincott, Beall & Company, San Francisco.

DIEHL MANUFACTURING COMPANY.
Marine Electric Company, San Francisco.

DEXTER WASHING MACHINE CO.
M. Seller & Co., Portland, Seattle, Spokane.

DONGAN ELECTRIC MANUFACTURING CO.
Sierra Electric Co., San Francisco.

DRAKE LOCK-NUT CO.
Waterhouse & Lester Co., Los Angeles.
Preer Tool & Supply Co., Portland, Ore.
Cragin & Co., Seattle, Wash.
Holly Mason Hdwe. Co., Spokane, Wash.

DUNCAN ELEC. MFG. CO.
Coast Equipment Co., San Francisco.

DUPLEX LINING WORKS OF GEN. ELEC.CO.
General Elec. Co., San Francisco, Los Angeles, Portland, Seattle, Spokane, Butte, Salt Lake City, Denver, Phoenix.

E. I. du PONT de NEMOURS CO.
E. I. du Pont de Nemours Co., San Francisco.

EARL P. COOPER AIRPLANE & MOTOR CO.
Earl P. Cooper Co., San Francisco and Los Angeles.
Harry E. Herndon, Inc., Los Angeles.

ECONOMY ENGINEERING CO.
Mailler Searles, San Francisco.

ECK DYNAMO & MOTOR CO.
Marine Electric Shop, Seattle, Wash.

THE ECLIPSE MACHINE COMPANY.
Panama Lamp & Commercial Co., San Francisco.
F. S. Spencer, Los Angeles, Cal.
Modern Appliance Co., Seattle, Wash.

ECONOMY ENGINEERING COMPANY.
Economy Engineering Co., San Francisco, Denver.

ECONOMY FUSE & MFG. CO.
Western Electric Co., Seattle, Portland, Spokane, San Francisco, Los Angeles, Salt Lake City.

EDISON ELECTRIC APPLIANCE CO.
Pacific States Elec. Co., San Francisco, Los Angeles, Seattle, Portland, Spokane.

EDISON LAMP WORKS
Pacific States Elec. Co., San Francisco, Los Angeles, Seattle, Portland, Spokane.
General Electric Co., San Francisco, Los Angeles, Portland, Seattle, Spokane, Butte, Salt Lake City, Denver, Phoenix.

EDWARD R. LADEW COMPANY, INC.
Edward R. Ladew Company, San Francisco.
Warren & Bailey Co., Los Angeles, Cal.
H. W. Sharpe Co., Portland, Ore.
Mine & Smelter Supply Company, Denver, Salt Lake.

ELECTRIC BOILER CORP.
Brevoort & Co., San Francisco.

ELECTRIC CONTROLLER & MFG. CO.
C. F. Henderson, San Francisco.
O. E. Thomas, Los Angeles.
W. M. Price, Seattle.

ELECTRIC FURNACE CONSTRUCTION COMPANY.
Electric Furnace & Construction Co., San Francisco, Cal.

ELECTRIC MACHINERY COMPANY.
Garland-Affolter Engineering Co., San Francisco, Cal.
O. E. Thomas Company, Los Angeles, Cal.
C. Kirk Hillman, Seattle, Wash.
W. F. Murphy, Denver, Colo.

ELECTRIC SERVICE SUPPLIES CO.
Electric Service Supplies Co., San Francisco, Cal., Los Angeles, Cal.
Franklin Sales Co., Denver, Colo.

ELECTRIC STORAGE BATTERY CO.
Electric Storage Battery Co., San Francisco.

ELECTRIC VACUUM CLEANER CO., INC.
Premier Service Company, San Francisco,

ELECTRICAL ENGINEERS EQUIPMENT CO.
Garland Affolter Eng. Co., Seattle, Wash., San Francisco, Cal.
Clapp & LaMoree, Los Angeles, Cal.
Arthur Purdon, Salt Lake City, Utah.
O. H. Davidson Equipment Company, Denver, Colo.

ELECTRICAL PRODUCTS CORPORATION.
Federal Electric Company, Salt Lake, Seattle, San Francisco.

ENAMELED METALS CO.
Illinois Elec. Co., Los Angeles.

ESTATE STOVE COMPANY, THE
Alexander & Lavenson Elec. Supply Co., San Francisco, Cal.
Listenwalter & Gough, Los Angeles, Cal.
North Coast Elec. Co., Seattle, Wash.

EUREKA VACUUM CLEANER CO.
Eureka Vacuum Cleaner Co., San Francisco, Cal., Spokane, Wash., Salt Lake City, Utah.
A. A. Wilson Co., Los Angeles, Cal.
Poole Electric Co., Seattle, Wash.
J. C. English Co., Portland, Ore.
Domestic Appliance Co., Denver, Colo.

FAIRBANKS, MORSE & CO.
Fairbanks, Morse & Co., Los Angeles, San Francisco, Seattle, Portland, Spokane, Salt Lake City.

FEDERAL ELEC. CO.
Federal Elec. Co., San Francisco.

FIBRE CONDUIT CO.
Pacific States Elec. Co., San Francisco, Los Angeles, Seattle, Portland.

FREE SEWING MACHINE CO.
Electric Railway & Mfgrs. Supply Co., San Francisco, Cal.
Fobes Supply Company, Portland, Ore., Seattle, San Francisco.
Illinois Electric Company, Los Angeles, Cal.
The Washington Elec. Supply Co., Spokane.
Inter-Mountain Electric Company, Salt Lake.
The Montana Electric Company, Butte, Mont.
The Mine & Smelter Supply Company, Denver, Colo.

G. & W. ELECTRIC SPECIALTY CO.
G. & W. Electric Specialty Co., Los Angeles, W. R. Hendry Co., Seattle, Wash.
Electric Material Co., San Francisco, Cal.

GENERAL DEVICES & FITTINGS CO.
Electric Material Co., San Francisco, Cal.

GENERAL ELEC. CO.
General Elec. Co., San Francisco, Los Angeles, Portland, Seattle, Spokane, Denver, Butte, Phoenix, Salt Lake City, Vancouver.

P. A. GEIER CO.
Listenwalter & Gough, Los Angeles.
Creighton Morris Co., Oakland
Capital Electric Co., Salt Lake City.

GENERAL RAILWAY SIGNAL CO.
Mangrum & Otter, Inc., San Francisco.
Marshall Wells Co., Portland, Ore.

A. C. GILBERT CO., THE
The A. C. Gilbert Co., San Francisco.

GILLESPIE EDEN CORPORATION.
Gillespie Eden Corporation, San Francisco.

GOODRICH RUBBER CO.
Goodrich Rubber Co., San Francisco, Los Angeles, Portland, Seattle, Denver and Salt Lake.

GRABLER MANUFACTURING CO., THE
Allied Industries, San Francisco, Los Angeles and Portland.
Wm. P. Horn Co., San Francisco.

GRATON & KNIGHT MANUFACTURING CO., THE
Graton & Knight Manufacturing Co., San Francisco, Cal., Seattle, Wash., Portland.

GRINNELL WASHING MACHINE CO.
California Hdw. Co., Los Angeles, Cal.
Heyman Weil Co., San Francisco, Cal.
Seattle Hdw. Co., Seattle.

GRETHER FIRE EQUIPMENT CO.
Sierra Electrical Co., San Francisco, Cal.

GRINNELL COMPANY.
Grinnell Company of the Pacific, San Francisco, Los Angeles, Seattle and Denver.

HABIRSHAW ELEC. CABLE CO.
Western Electric Co., San Francisco, Los Angeles, Portland, Seattle, Salt Lake City, Spokane, Butte, Denver.

HARDY F. A. & CO.
F. A. Hardy & Co., San Francisco and Denver.

HENKEL & BEST CO.
Federal Electric Co., San Francisco, Cal.

HENRY DISSTON & SONS.
Henry Disston & Sons, Inc., Portland, Ore., Seattle, Wash., San Francisco, Cal.

HERZOG MINIATURE LAMP CO.
Western Agencies Co., San Francisco.

HIGHLANDS MFG. CO.
Western Agencies Co., San Francisco, Cal.

HORTON MANUFACTURING COMPANY.
Baker, Hamilton & Pacific Co., San Francisco, Cal.
Holly-Mason Hdwe. Co., Spokane, Wash.
Salt Lake Hdwe. Co., Salt Lake City.
A. A. Wilson, Los Angeles, Cal.
Scott Electric Company, Portland, Ore.
Seattle Electric Washer Co., Seattle, Wash

HOWELL ELECTRIC MOTORS CO.
Garland Affolter Engineering Co., San Francisco, Los Angeles, Seattle.

HUBBARD & CO.
Pacific States Elec. Co., Los Angeles, San Francisco, Portland, Seattle, Spokane.

HURLEY MACHINE CO.
Pacific States Elec. Co., Los Angeles, San Francisco, Portland, Seattle, Spokane.

HYATT ROLLER BEARING CO.
Link-Belt Company, Portland, Ore.
Pacific States Rubber Co., Portland, Ore.
Brinckley Supply Co., Seattle, Wash.
Harron, Rickard & McCone, San Francisco, Cal., Los Angeles, Cal.
Llewellyn Iron Works, Los Angeles.
Inter-Mountain Engineering Co., Salt Lake City, Utah.

HYDRAULIC STEELCRAFT CO., THE
The Hydraulic Steelcraft Co., San Francisco.

IDEAL ELECTRIC, THE
Baker-Joslyn Company, San Francisco, Cal., Los Angeles, Cal., Seattle, Wash.

ILG ELECTRIC VENTILATING CO.
Tiltz Engrg. & Equip. Co., Los Angeles, Cal., San Francisco, Cal.
J. E. McCall, Portland, Ore.

INDEPENDENT LAMP & WIRE CO.
Panama Lamp & Commerical Co., San Francisco.
Capital Elec. Co., Denver.

INDEPENDENT PNEUMATIC TOOL CO.
Independent Pneumatic Tool Co., San Francisco, Cal.
Perine Machinery Company, Seattle, Wash.
Burton R. Stare, Seattle, Wash.
W. F. McKenney, Portland, Ore.
Rix Compressed Air & Drill Co., Los Angeles, Cal.
Frank Darling & Co., Vancouver, B. C.
Utah Machinery Co., Salt Lake, Utah.
Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

INDIANA RUBBER & INSULATED WIRE CO.
Fobes Supply Co., Portland, Seattle.

INTERIOR LAMP & FIXTURE WORKS.
E. C. Ochme, Berkeley.

INTERNATIONAL DEVICES COMPANY.
International Devices Co., San Francisco, Cal.
Shaw Supply Co., Tacoma, Wash., Seattle, Wash., Portland, Ore.

INTERNATIONAL ELECTRIC CO.
International Electric Co., San Francisco.

IVANHOE REGENT WORKS OF GENERAL ELEC. CO.
Pacific States Elec. Co., Butte, Phoenix, Salt Lake City, Portland, Seattle, Spokane, San Francisco, Los Angeles, Denver, Vancouver.

JEFFERSON ELEC. MFG. CO.
Illinois Elec. Co., Los Angeles.

JENKINS BROS.
Jenkins Bros., San Francisco.

JEWELL BELTING CO.
Holt Brothers Co., San Francisco.
Stephens-Adamson Co., Los Angeles, Cal.
Zion's Cooperative Mercantile Inst., Salt Lake, Utah.
Wolff Manufacturing Co., Denver, Colo.

JEWELL ELECTRICAL INSTRUMENT CO.
Jewell Electrical Instrument Co., San Francisco, Cal.
More Elec. Co., Denver, Colo.
Nixon-Kimmel Co., Spokane, Wash.
Burton R. Stare Co., Seattle, Wash.
R. E. Thomas Co., Los Angeles, Cal.

JOHNS-MANVILLE INC.
Johns-Manville Inc., Butte, Phoenix, Salt Lake City, Portland, Seattle, Spokane, San Francisco, Los Angeles, Denver, Vancouver.

M. W. KELLOGG CO.
The Pelton Water Wheel Co., San Francisco.

KILLARK ELECTRIC MFG. CO.
Geo. H. Maire, Seattle, Wash.
Myers & Schwartz, San Francisco, Cal.
Elec. Sales Co., Los Angeles, Cal.
Alex Hibbard, Inc., Denver, Colo.

KIMBLE ELEC. CO.
O. E. Thomas Co., Los Angeles, Cal.

KING WHITE WAY POSTS.
Western El. Co., San Francisco, Cal.

KINGSBURY MACHINE WORKS.
Kingsbury Machine Works, San Francisco, Cal.

KUHLMAN ELECTRIC CO.
C. F. Henderson, San Francisco.
O. E. Thomas Co., Los Angeles.
Austin Henderson Co., Spokane.

LAKEWOOD ENGINEERING CO.
Smith-Booth Usher Co., San Francisco, Los Angeles, Cal.
Clyde Equipment Co., Portland, Seattle, Spokane.
Morgan A. Tanner Co., Salt Lake.
C. H. Jones Co., Salt Lake.
American Machinery Co., Salt Lake, Utah.

LANDERS, FRARY & CLARK
Landers, Frary & Clark, San Francisco.

LARNER JOHNSON VALVE & ENG. CO.
C. P. Abbott, San Francisco.

LAUNDRYETTE MANUFACTURING CO., THE
Bell Supply Co., Seattle, Wash.
Electric Maid Shop, Portland, Ore.
de Jongh & Cochran, San Francisco, Cal.
Hendire & Bolthoff Mfg. & Supply Co., Denver, Colo.

LINCOLN ELECTRIC CO., THE
A. H. Peir & Co., Los Angeles, Cal.
Coast Equipment Co., San Francisco, Cal.
Eicher & Bratt, Seattle, Wash.

LINK-BELT PACIFIC COMPANY
Link-Belt Northwest Co., Seattle, Wash.
Link-Belt Northwest Co., Portland, Ore.
Link-Belt Pacific Co., Los Angeles, Cal.
Link-Belt Pacific Co., San Francisco, Cal.
Lindrooth, Shubart & Company, Denver, Colo.

LOCKE INSULATOR MFG. CO.
Pacific States Elec. Co., Portland, Seattle, Spokane, San Francisco, Los Angeles.

LOURIE MFG. CO.
Eccles & Smith, San Francisco, Los Angeles, Portland.

LUMINOUS SPECIALTY CO.
Bruce Daniels Co., San Francisco, Cal.

LUMINOUS UNIT CO.
Illinois Elec. Co., Los Angeles.

W. N. MATHEWS & BRO., INC.
Lewis E. Sperry, San Francisco.

MATHIAS KLEIN & SONS
Illinois Elec. Co., Los Angeles

McCLINTICK-MARSHALL CO.
McClintic-Marshall Co., San Francisco, Seattle.

McGILL MFG. CO.
Illinois Elec. Co., Los Angeles.
J. G. Pomeroy, Los Angeles.

MEDART PATENT PULLEY CO., INC.
Bodinson Manufacturing Co., San Francisco.

MEESE & GOTTFRIED CO.
Meese & Gottfried Co., Portland, Seattle, Los Angeles, San Francisco, Cal.

MIDWEST ENGINE COMPANY.
Midwest Engine Co., San Francisco, Cal.
A. H. Cox & Co., Seattle, Wash.
Midwest Engine Co., Salt Lake City, Utah.
Mountain States Machinery Co., Denver, Colo.

GEO. B. MILLER & SON CO.
Geo. B. Miller & Son Co., Los Angeles, Cal.

MILTON MANUFACTURING CO., THE
The Milton Manufacturing Co., Denver, Colo., San Francisco, Cal.
W. S. DePierris Co., Seattle, Wash.

MOLONEY ELECTRIC COMPANY.
Garland-Affolter Engineering Co., San Francisco, Cal., Los Angeles, Cal.
Moloney Electric Co., Seattle, Wash.
Mountain States Machy. Co., Denver, Colo.
Moloney Electric Co., Salt Lake, Utah.

MONARCH REFILLABLE FUSE CO.
Monarch Refillable Fuse Co., San Francisco, Los Angeles, Seattle, Denver.

MONROE CALCULATING MACHINE CO.
Monroe Calculating Machine Co., San Francisco, Los Angeles, Salt Lake, Seattle, Spokane, Portland, Butte.

MORGANITE BRUSH CO. INC.
Herzog Elec. & Engineering Co., San Francisco.
Charles Farnham, Los Angeles.
W. R. Hendry Co., Seattle.

WM. J. MURDOCK CO.
Keeler, White Co., San Francisco, Cal.

MUTUAL ELECTRIC & MACHINE CO.
Keeler-White Company., San Francisco, Cal.

MOSS-SCHURY MFG. CO.
W. L. Collins Co., Los Angeles, Cal.

NATIONAL BRAKE & ELECTRIC CO.
Westinghouse Pacific Coast Brake Co., Los Angeles, Cal.

NATIONAL CARBON CO.
National Carbon Co., San Francisco.
Illinois Elec. Co., Los Angeles.

NATIONAL CASH REGISTER CO., THE
The National Cash Register Co., Seattle, Salt Lake, Denver, San Francisco, Portland, Spokane, Phoenix, Butte, Los Angeles.

NATIONAL FIBRE & INSULATION CO.
F. J. Klench, San Francisco.

NATIONAL LAMP WORKS OF GENERAL ELEC. CO.
National Lamp Works, Oakland.

NATIONAL METAL MOLDING CO.
Illinois Elec. Co., Los Angeles.

NATIONAL SCREW & TACK CO., THE
The National Screw & Tack Co., San Francisco, Cal.

NEW YORK INSULATED WIRE CO.
Illinois Electric Co., Los Angeles.
Lewis & Sperry, San Francisco.

NEW YORK BELTING & PACKING CO.
New York Belting & Packing Co., San Francisco, Salt Lake.

NEW YORK LEATHER BELTING CO.
F. O. Stallman Supply Co., San Francisco.

NICHOLSON FILE COMPANY.
Osgood & Howell, San Francisco, Cal.

NORTH AMERICAN ELECTRIC LAMP CO.
Western Agencies Co., San Francisco.

NORTHWESTERN ELECTRIC COMPANY.
W. Montelius Price Co., Seattle, Wash.
American Type Founders Co., San Francisco, Cal.
W. F. Murphy, Denver, Colo.

NORTHWESTERN MFG. CO.
Northwestern Mfg. Co., Los Angeles, Cal.

OHIO BRASS CO.
Ohio Brass Co., San Francisco, Los Angeles.

OHIO ELECTRIC & CONTROLLER CO.
Ohio Electric & Controller Co., San Francisco.

OSBORN MANUFACTURING CO., THE
The Osborn Manufacturing Co., San Francisco, Cal.

OVERBACH & AYRES MFG. CO.
Graham-Reynolds Electric Co., Los Angeles, Cal.
Alexander & Lavenson Electrical Supply Co., San Francisco, Cal.
Fobes Supply Co., Portland, Ore., Seattle, Wash., San Francisco.
Washington Elec. Supply Co., Spokane, Wash.
Cope & Son, Ltd., Vancouver, B. C.

PACIFIC MFG. & ELEC CO.
Electric Appliance Co., San Francisco.
Stubbs Elec. Co., Portland.

PACIFIC TANK & PIPE CO.
Herr & Rubincon Supply Co., Denver, Colo.
Burton Lbr. Co., Salt Lake, Utah.
Pacific Tank & Pipe Co., San Francisco, Cal., Los Angeles, Cal.

PAUL W. KOCH & CO.
Paul W. Koch & Co., San Francisco, Cal.

J. H. PARKER & SONS, INC.
Illinois Elec. Co., Los Angeles.

PAWLING & HARNISCHFEGER CO.
Pawling & Harnischfeger Co., San Francisco, Cal., Los Angeles, Cal., Portland, Ore., Seattle, Wash.
Landes & Co., Salt Lake City, Utah, Denver, Colo.

PECK, STOW & WILCOX CO., THE
Osgood & Howell, San Francisco, Cal.

PEERLESS ELEC. CO.
Garland-Affolter Engineering Co., San Francisco, Seattle, Los Angeles.

PEERLESS LIGHT CO.
Baker-Smith Co., San Francisco, Cal.

PELTON WATER WHEEL CO., THE
The Pelton Water Wheel Co., San Francisco.

PENBERTHY INJECTOR CO.
Lippincott-Beall Co., San Francisco, Los Angeles, Cal., Seattle, Wash.

PENNSYLVANIA WIRE GLASS COMPANY.
Rolph, Mills & Co., San Francisco, Cal., Seattle, Wash., Portland, Ore., Los Angeles, Cal.

PERFECTLITE MFG. CO.
Myers & Schwartz, San Francisco, Los Angeles, Seattle.

PIERCE FUSE CORP.
Baker-Joslyn Co., Los Angeles, San Francisco, Seattle.

PIONEER RUBBER MILLS.
Western Belting & Packing Co., Denver, Colo.
Utah Machinery Company, Salt Lake, Utah.
Washington Belting & Rubber Co., Seattle, Wash.
Munnell & Sherrill, Portland, Ore.
Pioneer Rubber Mills, Los Angeles, Cal.

PITTSBURGH FURNACE CO.
Pittsburgh Furnace Co., San Francisco, Cal.

PITTSBURGH PIPING & EQUIPMENT CO.
Pittsburgh Piping & Equipment Co., San Francisco.

PITTSBURGH REFLECTOR CO.
Meyers & Schwartz, San Francisco.

PITTSFIELD MACHINE & TOOL CO., THE
The Pittsfield Machine & Tool Co., San Francisco, Cal.

PLYMOUTH CORDAGE CO.
N. Porter Saddle & Harness Co., Phoenix.
Johnson, Joseph & A. M. Josselyn & Co., San Francisco, Cal.
Trilch Hardware Co., Denver, Colo.
Anaconda Copper Mining Co., Butte, Mont.
Oregon Marine & Fisheries Supply Co., Portland, Ore.
The Beebe Co., Portland, Ore.
Consolidated Wagon & Machine Co., Salt Lake, Utah.
Pacific Net & Twine Co., Seattle, Wash.
Independent Cordage Co., Ltd., Vancouver, B. C.

PYRENE MANUFACTURING CO.
Pyrene Mfg. Co., San Francisco.

RAMEY MFG. CO., THE
The Ramey Mfg. Co., Portland, Ore.
RATHBONE, SARD & CO.
Rathbone, Sard & Co., San Francisco, Cal., Los Angeles, Cal., Seattle, Wash.
REDWOOD MANUFACTURERS CO.
Redwood Manufacturers Co., San Francisco.
Redwood Manufacturers Co., Los Angeles.
D. C. Dunbar Co., Salt Lake City.
F. N. Flynn, Phoenix.
REPUBLIC FLOW METERS CO.
Halloran & Golcher, San Francisco, Cal.
The Great Western Engineering & Sales Co., Denver, Colo.
GEORGE RICHARDS & CO.
Gerige A. Gray Co., San Francisco.
RIDGWAY DYNAMO & ENGINE CO.
Coast Equipment Co., Los Angeles, San Francisco.
RETHERFORD R. MILT
The Kaufman Co., Los Angeles.
RITER-CONLEY COMPANY,
Riter-Conley Co., San Francisco, Seattle.
ROBBINS & MYERS CO.
Robbins & Myers Co., San Francisco.
H. H. ROBERTSON CO.
H. H. Robertson Co., San Francisco, Los Angeles, Seattle.
P. L. Cherry & Co., Portland
ROEBLING SONS CO., JOHN A.
John A. Roeblings Sons Co. of Cal., San Francisco, Los Angeles, Portland, Seattle.
ROLLER-SMITH CO.
Roller-Smith Co., San Francisco.
ROME ELEC'L CO.
Elec. Materials Co., San Francisco.
ROME WIRE CO.
J. G. Pomeroy, Los Angeles.
ROTH BROS. & CO.
C. Kirk Hillman Co., Seattle.
SAFETY INSULATED WIRE & CABLE CO.
Safety Insulated Wire & Cable Co., Los Angeles, San Francisco.
North Coast Elec. Co., Portland, Seattle.
CHAS. A. SCHIEREN COMPANY
Chas. A. Schieren Company, San Francisco, Seattle, Denver.
S. ROBERT SCHWARTZ & BRO.
Meyers & Schwartz, San Francisco.
SHEPARD ELECTRIC CRANE & HOIST CO.
Shepard Electric Crane & Hoist Co., San Francisco, Los Angeles, Denver.
Coldy Steel & Eng. Co. Seattle Los Angeles, Denver.
SQUARE-D CO.
W. I. Otis, San Francisco.
SIMPLEX WIRE & CABLE CO.
Simplex Wire & Cable Co., San Francisco.
SIMPLEX ELEC. HEATING CO.
Holbrook, Merrill & Stetson, San Francisco, Los Angeles.
M. Seller & Co., Portland, Seattle, Spokane.
Intermountain Elec. Co., Salt Lake City.
S. MORGAN SMITH CO.
S. Morgan Smith Co., San Francisco
SPRAGUE ELEC. WORKS OF GENERAL ELEC. CO.
General Elec. Co., Butte, Phoenix, Salt Lake City, Portland, Seattle, Spokane, San Francisco, Los Angeles, Denver, Vancouver.
STANDARD PRESSED STEEL CO.
Herberts Mach'g. & Supply Co., Los Angeles, San Francisco.
Meese & Gottfried Co., Los Angeles, San Francisco, Seattle Portland.
Waterhouse & Lester, San Francisco.
Eccles & Smith, San Francisco.
Arizona Hdwe, & Supply Co., Phoenix
Mine & Smelter Supply Co., Salt Lake City.
STANDARD UNDERGROUND CABLE CO.
Standard Underground Cable Co., San Francisco, Los Angeles, Seattle, Salt Lake City.
STANLEY & PATTERSON ELEC. SPE'TIES
Stanley & Patterson Elec. Specialties, San Francisco, Seattle.
Clapp & LaMoree, Los Angeles.
STEATITE ELECTRIC PRODUCTS CORP.
Western Agencies Co., San Francisco.
STERLING STAMPING CO.
Elec. Materials Co., San Francisco.
STOW MFG. CO., INC.
Harron, Rickard McCone, San Francisco, Los Angeles.
Shaw-Palmer, Bakewell Co., Los Angeles
Berger & Carter, San Francisco.
Pacific Tool & Supply Co., San Francisco.
STUEBING TRUCK CO., THE
The Tindolph Co., Seattle.
Stuebing Truck Co., Los Angeles.
SUN-RAY MFG. CO., THE
Panama Lamp & Commercial Co., San Francisco.
SURF MFG. CO.
Surf Mfg. Co., San Francisco.
Electric Appliance, Seattle.
TECHNICAL COLOR AND CHEMICAL CO.
Meyers & Schwartz, San Francisco.
R. THOMAS & SONS CO.
Western Elec. Co., San Francisco, Los Angeles, Portland, Seattle, Spokane, Salt Lake City.
THORDARSON ELEC. MFG. CO.
Thordarson Elec. Mfg. Co., San Francisco.
TIDEMAN ELEC. MFG. CO.
Globe Commercial Co., San Francisco.
TRIUMPH EL. CO.
H. F. Watkins Co., San Francisco.
Thos. W. Simon Co., San Francisco.
Triumph El. Co., Seattle.
TRUMBULL ELEC. MFG. CO.
Trumbull Elec. Mfg. Co., San Francisco.
TRUSCON STEEL CO.
Truscon Steel Co., Spokane, Portland, Salt Lake City, Los Angeles, San Francisco, Denver, Seattle.
UNION EL. MFG. CO.
Garland, Affolter Eng. Co., San Francisco Seattle, Los Angeles.
UNION ELECTRICAL MFG. CO.
Garland-Affolter Eng. Co., Los Angeles, San Francisco, Seattle.
UNITED STATES RUBBER CO.
United States Rubber Co., San Francisco, Los Angeles, Seattle, Salt Lake City, Denver.
UNITED STATES STEEL PRODUCTS CO.
United States Steel Products Co., San Francisco.
UNIT ELEC. CO.
Baker-Joslyn Co., San Francisco, Los Angeles, Seattle.
U. S. ELEC. MFG. CO.
U. S. Elec. Mfg. Co., Los Angeles.
VALLEY ELECTRIC CO.
Star Machinery Co., Seattle.
Child, Day & Churchill, Spokane.
Dunning Iron & Elec. Co., Los Angeles
VICTOR X-RAY CORP.
Dental Specialty Co., Denver.
Edwards Dental Supply Co., San Francisco.
Patterson Dental Supply Co., Spokane, Seattle,
Temple-Patterson Co., Ltd., Vancouver, B. C.
Welch Dental Depot, Portland.
Western Dental Supply Co., Salt Lake City.
VOSS BROS. MFG. CO.
Heyman Weil Co., San Francisco.
R. M. Burton Sales Agency, Seattle.
V.V. FITTINGS CO.
Baker-Joslyn Co., San Francisco, Los Angeles, Seattle.
WAGNER ELEC. MFG. CO.
Wagner Elec. Mfg. Co., San Francisco.
F. W. WAKEFIELD BRASS CO.
Capital Electric Co., Salt Lake City.
WARD LEONARD ELEC. CO.
Electrical Material Co., San Francisco.
WATERBURY MANUFACTURING CO.
F. J. Klench Co., San Francisco.
WAYNE MFG. CO.
Capital Elec. Co., Salt Lake City.
Spokane Drygoods Co., Spokane.
Whiton Hardware Co., Seattle.
Parmalee-Dohrmann Co., Los Angeles
Nathan, Dohrmann Co., San Francisco.
WESTERN ELEC. CO.
Western Elec. Co., San Francisco, Los Angeles, Portland, Seattle, Spokane, Salt Lake City, Denver.
WESTERN PUMP CO.
Western Pump Co., Portland, Seattle.
WESTINGHOUSE ELEC. & MFG. CO.
Westinghouse Elec. & Mfg. Co., Butte, Phoenix, Salt Lake City, Portland, Seattle, Spokane, San Francisco, Los Angeles, Denver, Vancouver.
Electric Railway and Mfrs. Supply Co., San Francisco.
WHIRLPOOL MFG. CO.
Whirlpool Mfg. Co., San Francisco, Salt Lake City.
WHITE SEWING MACHINE CO.
White Sewing Machine Co., San Francisco.
J. H. WILLIAMS CO., Drop Forgings and Tools
J. H. Williams Co., San Francisco.
WIRT CO.
Benjamin Elec. Mfg. Co., San Francisco.
WISCONSIN ELECTRIC CO.
Nixon Elec. Co., Spokane.
Eccles & Smith, Portland, San Francisco.
Clapp & LaMoree, Los Angeles
Fred Ward & Sons, San Francisco.
Water House, Lester Co., San Francisco.
Hendrie & Bolthoff Mfg. Co., Denver.
Capital Electric Co., Salt Lake City.
Seattle Hardware Co., Seattle.
WORTHINGTON PUMP & MACH'Y CORP.
Worthington Pump & Machinery Corp., Denver, Los Angeles, Salt Lake City, San Francisco, Seattle.

List of Western Representatives

ABBOTT, C. P.
Call Bldg., San Francisco
Larner-Johnson Valve & Engine Co.
ALEXANDER & LAVENSON ELECTRICAL SUPPLY CO.
132 Second St., San Francisco
Bluebird Elec. Clothes Washers and Sewing Machines
Estate Elec. Ranges, "Oamco" Reflectors
Manning-Bowman Heating Appliances
Edward Miller Co.
Lighting Fixtures
Wheeler Reflector Co.
I. P. Frink Company
Lighting Equipment
Estate Stove Company
ALLEN, FRANK M. Co.
423-4 McIntyre Bldg., Salt Lake City
Truscon Steel Co.
ALLIED IND. OF SAN FRANCISCO
Grabler Mfg. Co.
"Duraduct"—conduit
"Duracord"—portable cord
"T-V" Knife switches and switch boards
"Mason" Safety Switches
Collyer Insulated Wire Co.
"Wirelets"
"Fullman" Bushings and Locknuts
"Steel City" Switch and Outlet Boxes
"Campbell" Attachment Plugs and Receptacles
"Universal"
"Marchand" Clamps, Guy Wire Hooks, etc.
"1919" Ideal Knobs, Tubes, Cleats, etc.
American Porcelain Company
"Buckeye" Conduit
"Realflex", Armored Cord and Cable
ALLIS-CHALMERS MFG. CO.
San Francisco, Los Angeles, Portland, Seattle, Spokane, Salt Lake City, Phoenix, Denver, Butte, Vancouver, B. C.
Allis-Chalmers Mfg. Co.
ALTORFER BROS.
San Francisco
Altorfer Bros.
ALUMINUM CO. OF AMERICA
San Francisco
Aluminum Co. of America
AMBLER & RITER
Kearns Bldg., Salt Lake City
"Whirlpool Sanitary Dishwashers"
Automatic Reclosing Circuit Breaker
AMERICAN BLOWER CO.
Boston Bldg., Salt Lake City
605 Leary Bldg., Seattle
616 Newhouse Bldg., Salt Lake City
"Sirocco" Fans, Engines, Blowers, etc.
NATIONAL CARBON CO.
American Ever-Ready Works, San Francisco
AMERICAN MACHINERY CO.
810 Walter Bldg., Salt Lake City
Lakewood Eng. Co.
AMERICAN MFRS. & EXP. CO.
Seattle
Chandeyson Elec. Co.
AMERICAN PAPER CO.
Seattle
Columbian Rope Co.
AMERICAN PULLEY CO.
536 1st Ave. S., Seattle
14 Natoma St., San Francisco
639 Mill St., Los Angeles
Pulleys and Hoisting Apparatus
AMERICAN ROLLING MILLS
10th and Bryant Sts., San Francisco
Armco Culverts and Flumes
AMERICAN TYPE FOUNDERS CO.
820 Mission St., San Francisco
N. W. Elec. Co.
Rotary Conveyors and Motors
ANACONDA COPPER MINING CO.
Butte
Plymouth Cordage
"Sirocco" Fans and Blowers
APEX APPLIANCE CO.
222 San Fernando Bldg., Los Angeles
Apex Appliance Co.
ARIZONA HDW. & SUPPLY CO.
Phoenix
"Standco" Set Screws, Steel Shaft Hangers
ARLIN, A. W.
772 Pac. Elec. Bldg., Los Angeles
Elec. Service Supplies Co.
ASSOCIATED SUPPLY CO.
San Francisco
Chisholm Moore Mfg. Co.

ARROW ELEC. CO.
579 Howard St., San Francisco
Arrow Elec. Co.

ATLAS PACKING & RUBBER CO.
Seattle
Clipper Belt Lacer Co.

AUSTIN-HENDERSON CO.
Spokane
Kuhlman Elec. Co.

BAKER, HAMILTON & PACIFIC CO.
San Francisco
Columbian Rope Co.
Horton Mfg. Co.
Washers

BAKER-JOSLYN CO.
199 First St., San Francisco
Los Angeles
Seattle
Ideal Elec. & Mfg. Co.
Acme Wire, Coils, etc., Pierce Fuses
"American Brand" Wire and Cables
Burnley Battery & Mfg. Co.
Detroit Insulated Wire Co.
John C. Dolph Company
S. R. Fralick & Co., Chicago
Illinois Elec. Porcelain Co.
Indiana Steel & Wire Co.
Jefferey-Dewitt Insulator Co.
Joslyn Mfg. & Supply Co.
National Enameling & Mfg. Co.
Pierce Renewable Fuses
V V Conduit Fittings

BAKER-SMITH CO.
Rialto Bldg., San Francisco
Peerless Elec. Floor and Table Lamps

BALLWEG & CRANDALL
The Dalles, Oregon
Allis-Chalmers Mfg. Co.
Westinghouse Elec. & Mfg. Co.

BARNETT, M. S.
104 Bush St., San Francisco
Acorn Ranges

BARRETT, F. D.
2718 Elliott Ave., Seattle
Acorn Ranges

BASFORD, H. R.
431 Sutter St., San Francisco
Surf Elec. Washing Machines

BEEBE CO., THE
First and Washington Sts., Portland
Plymouth Cordage
Carlisle & Finch

BELL SUPPLY CO.
418 Union St., Seattle
"Laun-Dry-Ette" Washers

BENJAMIN ELEC. MFG. CO.
580 Howard St., San Francisco
Weib Co.

BENTLEY, ROY
201 Worchester Bldg., Portland
Clements Mfg. Co.
Vacuum Cleaners

BERGER & CARTER CO.
365 Market St., San Francisco
Stow Flexible Shafts
Wisconsin Elec. Co.
Trolleys, Castings, Hoists

BETHLEHEM STEEL CO.
Monadnock Bldg., San Francisco
Bethlehem Steel Co.

BIEL & CO., J. T.
846 So. Main St., Los Angeles
Cleveland Alternating Current Motors

BLACKBURN, W.
Higgins Bldg., Los Angeles
A. S. Cameron Steam Pumps

BLAKE, McFALL CO.
Portland
Columbian Rope Co.

BODLER, F. F.
903 Monadnock Bldg., San Francisco
Elec. Service Supplies Co.

BODINSON MFG. CO.
11 Minna St., San Francisco
Medart Patent Pulley Co.

BOYD, I.
400 E. Third St., Los Angeles
Meese & Gottfried Co.

BREEVORT & CO.
Monadnock Bldg., San Francisco
Bissell Electric Suction Cleaner
Regina Vacuum Cleaner
Electric Boilerette

BRINCKLEY SUPPLY CO.
Seattle
Hyatt Roller Bearing Co.

BROWN-BEVIS CO.
422 E. Third St.
Blaw Forms
Blaw-Knox Co.

BURTON LUMBER CO.
319-322 Newhouse Bldg., Salt Lake City
Pac. Tank & Pipe Co.

BURTON SALES AGENCY, R. M.
Seattle
Voss Washing Machines

BURTON R. STARE CO.
325 Yessler Way, Seattle
Pneumatic and "Thor" Elec. Tools
Jewell Elec. Instruments

BUTTRESS & McCLELLAN
Los Angeles
"Standco" Set Screws and Steel Shaft Hangers

CALIFORNIA HARDWARE CO.
Los Angeles
Grenell Washing Machine

CALIFORNIA PUMP CO.
919 Sixth St., Sacramento
Westco Pumps and Water Systems

CANADIAN INGERSOLL-RAND CO.
780 Beatty St., Vancouver, B. C.
A. S. Cameron Steam Pumps

CAPITOL ELECTRIC CO.
19 W. First South St., Salt Lake City
Red Spot Lighting Specialties
Wisconsin Elec. Co.
"Wayne" Elec. Clothes Washer
Royal Vacuum Cleaners
Tungsol Lamps

CARTER, R. B.
W. 617 First Ave., Spokane
Eureka Vacuum Cleaners

CARTER, H. E.
W. 333 Sixth North, Spokane
Eureka Vacuum Cleaner

CENTURY ELEC. CO.
San Francisco, Portland, Los Angeles,
Salt Lake City, Denver
Century Elec. Co.

CHERRY & CO., P. L.
271 Hawthorne Ave., Portland
H. H. Robinson Co.,
Bldg. Materials

CHICAGO PNEUMATIC TOOL CO.
307 E. Third St., Los Angeles
175 First St., San Francisco
119 Jackson St., Seattle
Chicago Pneumatic Tool Co.

CHILD, DAY & CHURCHILL
Spokane
Valley Elec. Co.
Motors and Battery Charging Devices

CLAPP & LA MOREE
San Fernando Bldg., Los Angeles
Elec. Engr. Equipment Co.
"Loomflex" Flexible and Enameled Conduit
Stanley & Patterson
Wisconsin Elec. Co.
Chicago Mica Co.

CLEMENTS MFG. CO.
1427 Fifth Ave., Seattle
Vacuum Cleaners

CLEVELAND, W. L.
Los Angeles
Geo. B. Miller & Son Co.

CLYDE EQUIPMENT CO.
18th and Upshur Sts, Portland
542 First Ave. South, Seattle
Spokane
321 Yates Bldg., Boise
Lakewood Engr. Co.

COAST EQUIPMENT CO.
Merchants Exch. Bldg., San Francisco
Lincoln Elec. Co.
Atlas Car & Mfg. Co.
Duncan Elec. Mfg. Co.
Ridgway Dynamo & Engine Co.

COFFIELD WASHER CO.
436 Sixteenth St., Denver
Coffield Washing Machines

COLBY STEEL & ENGINEERING CO.
Central Bldg., Seattle
Shepard Elec. Crane & Hoist Co.

COLLINS CO., W. L.
541 Chamber of Commerce Bldg., Los Angeles
"Repeater" Fuse Plugs

CONSOLIDATED WAGON & MACHINE CO.
Salt Lake City
Plymouth Cordage

CONTINENTAL FIBRE CO.
San Francisco, Los Angeles
Continental Fibre Co.

COOPER CO., EARL P.
1501 Sutter St., San Francisco
Earl P. Cooper Airplanes and Motors

COPE & SON, LTD.
Vancouver, B. C.
"Oamco" Reflectors

COX & CO., A. H.,
307 First St., Seattle
Midwest Engine Co.

CRAGIN & CO.
Seattle
Drake Lock-Nut

CRANE COMPANY
346 Ninth St., Los Angeles
Twentieth St. and Wall Ave., Ogden
160 Fourteenth St. N., Portland
307 W. Second St., Salt Lake City
301 Brannan St., San Francisco
419 Second Ave. S., Seattle
126 Post St., Spokane
Crane Company

CREIGHTON MORRIS CO.
316 Twelfth St., Oakland
Royal Vacuum Cleaners

CROCKER-WHEELER CO.
San Francisco
Crocker-Wheeler Co.

CROWE & CO., F. T.
1103 First Ave., Seattle
Blaw-Knox Co.

CULBERTSON-GROTTE-RANKIN
Spokane
Bluebird Elec. Clothes Washer

CURREY, J. A.
194 North Thirteenth St., Portland
Truscon Steel Co.

CURTIS ENGINEERING CO.
610 Pacific Elec. Bldg., Los Angeles
Booth Elec. Furnaces

CUTLER-HAMMER CO.
San Francisco, Los Angeles, Seattle
Cutler-Hammer Co.

DANIELS, BRUCE
1 Urbano Drive, San Francisco
Luminous Specialty Co.
International Elec. Co.

DARTING & CO., FRANK
Vancouver, B. C.
Independent Pneumatic Tool Co.
"Thor" Elec. Tools

DAVIDSON EQUIPMENT CO., O. H.
1633 Tremont St., Denver
Elec. Engr. Equipment Co.

deJONGH-COCHRAN CO.
880 Mission St., San Francisco
"Laun-Dry-Ette" Washer
Delco Light

DELTA STAR ELEC. CO.
59 Broadway, Salt Lake City
1633 Tremont St., Denver
Hoge Bldg., Seattle
Delta Star Elec. Co.

DENNY, CLARENCE P.
524 First Ave., South, Seattle
Ajax Elec. Specialties

DENTAL SPECIALTY CO.
Denver
Victor X-Ray Corp.

DISSTON & SONS., INC., HENRY
Portland
322 Occidental Ave., Seattle
133 Second St., San Francisco
Vancouver, B. C.
Henry Disston & Sons

DOERR-MITCHELL ELEC. CO.
Spokane
Coffield Washing Machines

DOMESTIC APPLIANCE CO.
5140 California St., Denver
Eureka Vacuum Cleaners

DUNBAR CO., D. C.
Walker Bank Bldg., Salt Lake City
Redwood Mfgrs. Co.

DUNNING IRON & ELEC. CO.
Los Angeles
Valley Elec. Co.

DU PONT de NEMOURS CO., E. I.
Chronicle Bldg., San Francisco
Du Pont Products

ECCLES & SMITH
San Francisco, Los Angeles, Portland
"Standco" Set Screws and Shaft Hangers
Lourie Mfg. Co.
Wisconsin Elec. Co.

ECONOMY ENGINEERING CO.
Rialto Bldg., San Francisco
211 Tramway Bldg., Denver
Portobee Elevators and Tiering Machines

EDWARDS CO., JAMES
San Francisco
Victor X-Ray Corp.

EICHELBERGER, KIRK W.
Rialto Bldg., San Francisco
Midwest Engine Co.
Gardner Governor Co.
Fawcet Machine Co.

EICHERT & BRATT
L. C. Smith Bldg., Seattle
Lincoln Elec. Co.
Automatic Reclosing Circuit Breakers

ELLIS, R. G.
636 Bush St., San Francisco
"American" Elec. Heating Devices

ENGLISH, J. C.
148 Fifth St., Portland
Eureka Vacuum Cleaner
Apex Appliance Co.

ELECTRIC APPLIANCE CO.
Seattle, San Francisco
Surf Elec. Washing Machines
"Oamco" Reflectors
Pacific Mfg. & Elec. Co.

ELEC. FURNACE CONST. CO.
519 California St., San Francisco
Elec. Furnace Const. Co.

ELEC. MAID SHOP
Portland
"Laun-Dry-Ette" Washers

ELEC. MATERIAL CO.
589 Howard St., San Francisco
Gen. Devices & Fittings Co.
Ward Leonard Elec. Co.
American Copper Products Co.
Roller-Smith Co.
Bates Expanded Steel Truss Co.
Barnes & Irving, Inc.
Rome Elec. Co.
Sterling Stamping Co.
G. & W. Elec. Specialty Co.

ELEC. RAILWAY & MFRS. SUPPLY CO.
36 Second St., San Francisco
Westinghouse Elec. & Mfg. Co.
Stanley & Patterson
Free Sewing Machine Co.
Irvington Varnish & Insulating Co.
Wilmington Fibre & Specialty Co.
Apex Vacuum Cleaners and Rotapex Washers
Westinghouse Mazda Lamps
Rome Wire Company
Four-in-One Fixtures
Anchor Webbing Company

ELEC. SALES CO.
253 S. Broadway, Los Angeles
Killark Safety Fuses, Switch Boxes, Etc.

ELEC. SPECIALTY CO.
525 Market St., San Francisco
Micanite Plates, Empire Cloths, Kablak Cloth, Kablak and Linotape, Linen and Silk Tapes, Micanite Cloths and Papers, Insulating Compounds
Eugene Munsell & Co., N. Y.
Barkelew Elec. Mfg. Co.
Metropolitan Elec. Mfg. Co.
Monarch Refillable Fuse Co., N. Y.
Bakelite-Dilecto and Vulcanized Fibre, Conite
Corliss Carbon Co.
Reynolds Elec. Co.

ELEC. STORAGE BATTERY CO.
1536 Bush St., San Francisco
Elec. Storage Battery Co.

FAIRBANKS, MORSE & CO.
Los Angeles, Portland, Salt Lake City, Seattle, Spokane, San Francisco
Fairbanks, Morse & Co.
Chisholm Moore Mfg. Co.

FARNHAM, CHAS.
207 I. W. Hellman Bldg., Los Angeles
G. & W. Elec. Specialty Co.
Morganite Brushes

FEDERAL ELEC. CO.
91 New Montgomery St., San Francisco
Henkel & Best Co.
Elec. Fixtures
"Flexlume"

FELT, R. H.
611 Walker Bldg., Salt Lake City
E. J. Chapin Co.

FLYNN, F .N.
Phoenix
Redwood Mfrs. Co.

FOBES SUPPLY CO.
Portland, Seattle, San Francisco
Chicago Insulated Wire & Mfg. Co.
Free Sewing Machines
"Oamco" Reflectors
Indiana Rubber & Insulating Wire Co.

FORMANEKS FARMERS SUPPLY CO.
Fresno
Geo. B. Miller & Son Co.

FRANKLIN SALES CO.
Denver
Allen Brady Co.

GALIGHER MACHINE CO.
Salt Lake City
Clipper Belt Lacer Co.

GARLAND-AFFOLTER ENGR. CO.
321 Rialto Bldg., San Francisco
I. W. Hellman Bldg., Los Angeles
L. C. Smith Bldg., Seattle
Moloney Elec. Co.
Allen Bradley Co.
Howell Electric Motors Co.
The Peerless Elec. Co.
Union Elec. Mfg. Co.
Elec. Mach. Co.
Electrical Engineers Equip. Co.

GENERAL ELEC. CO.
San Francisco
Los Angeles
Portland
Seattle
Spokane
Salt Lake City
Butte
Denver
General Electric Co.

GEORGE CO., INC., A. F.
200 N. Los Angeles St., Los Angeles
Chain Belt Co.

GILLESPIE EDEN CORP.
329 Rialto Bldg., San Francisco
Eden Washing Machines

GLOBE COMMERCIAL CO.
615 Mission St., San Francisco
"Hold-Heet" Pads, "Service" Curling Irons, Toasters
"Supedo" Hair Waver
"Menominee" Motors and Fans
"Domanco" Irons
"Sturdy" Plugs
"Superior" Water Heaters
"Midget" Irons
"Matchless" Gas Lighter
"America" Vacuum Cleaner
"Fitzall" Plugs
"Auto Vacuum" Ice Cream Freezers

GOODRICH RUBBER CO.
946 S. Broadway, Los Angeles
401 Mission St., San Francisco
Broadway and Burnside, Portland
113-15 King St., Seattle
42 East Fourth St., Salt Lake City
1422 Court Place, Denver
Goodrich Rubber Co.

GOSROW, R. C.
Whitcomb Hotel, San Francisco
Pittsburgh Elec. Furnace Co.

GOTTHEIM, I.
Colman Bldg., Seattle
Rite-Conley Co.
McClintic-Marshall

GRAHAM REYNOLDS ELEC. CO.
30 East Third St., Los Angeles
"Oamco" Elec. Light Reflectors
Crescent Insulated Wire

GRAY CO., GEO. A.
589 Mission St., San Francisco
Crescent Insulated Wire
W. B. Austin & Co.
Geo. Richards & Co.

GRATON & KNIGHT MFG. CO.
320 Occidental Ave., Seattle
Portland
Clipper Belt Lacer Co.
Graton & Knight Mfg. Co.

GREAT WESTERN ENGR. & SALES CO.
Denver
Republic Flow Meters Co.

GRINNELL CO.
453 Mission St., San Francisco
439 E. Third St., Los Angeles
L. C. Smith Bldg., Seattle
1140 Hamilton St., Vancouver
Grinnell Automatic Sprinklers

GUERNSEY CO., R. B.
420 East Third St., Los Angeles
155 Second St., San Francisco
"Sirocco" Fans, Engines, Blowers, etc.

GUTE & CO., H. J.
150 Post St., San Francisco
"Bee-Vac" Elec. Cleaner
Handel Mfg. Co.

HALLORAN & GOLCHER
Sharon Bldg., San Francisco
Republic Flow Meters Co.

HARDY & CO., F. A.
Phelan Bldg., San Francisco
Denver, Colo.
Safety and First Aid Equipment

HARPER & REYNOLDS CO.
Los Angeles
Columbian Rope Co.

HARRON, RICKARD & McCONE
139 Townsend St., San Francisco
Los Angeles
Hyatt Roller Bearing Co.
Stow Flexible Shafts

HEBER, J. E.
1480 Fourth St., Los Angeles
Truscon Steel Co.

HENDREY CO., W. R.
Hoge Bldg., Seattle
G. & W. Elec. Specialties
Morganite Brushes

HENDRIE & BOLTHOFF MFG. SUPPLY CO.
1635 Seventeenth St., Denver
"Laun-Dry-Ette" Washer
Independent Pneumatic Tool Co.
Chisholm, Moore Mfg. Co.
Clipper Belt Lacer Co.
Wisconsin Elec. Co.

HERNDON, HARRY E., INC.
810 So. Olive St., Los Angeles
Earl P. Cooper Airplanes and Motors

HERBERTS MACHINERY & SUPPLY CO.
405 E. Third St., Los Angeles
Wisconsin Elec. Co.
Standard Pressed Steel Co.

HERR-RUBICAN SUPPLY CO.
First Natl. Bank Bldg., Denver
Pacific Tank & Pipe Co.

HERZOG ELEC. & ENG. CO.
150 Steuart St., San Francisco
Carlisle & Finch
Morganite Brushes

HEYMAN-WEIL CO.
720 Mission St., San Francisco
Voss Washing Machines

HEXTER & CO.
Portland
Charter Oak Stoves

HILLMAN CO., C. KIRK
538 First Ave. South, Seattle
Roth Bros. & Co.
Elec. Machinery Co.

HOADLEY, P. L.
609 Seaboard Bldg., Seattle
Stanley & Patterson

HOLBROOK, MERRILL & STETSON
San Francisco, Los Angeles
Simplex Elec. Heating Co.

HOFIUS-FERRIS EQUIP. CO.
So. 17 Washington St., Spokane
Chain Belt Co.
Blaw-Knox Co.

HOLLOWAY, CHAS., JR.
Tenth and Bryant Sts., San Francisco
Truscon Steel Co.

HENDERSON, C. F.
Call Bldg., San Francisco
The Automatic Reclosing Circuit Breaker Co.
Elec. Controller & Mfg. Co.
Kuhlman Elec. Co.
Esterline Instruments

HOLLIDIE MACH. CO.
L. C. Smith Bldg., Seattle
Conveyors Corp. of America

HOLLEY-MASON HDW. CO.
Spokane
Horton Mfg. Co.
Drake Lock-Nut
Charter Oak Stoves

HOLT BROTHERS MFG. CO.
914 Folsom St., San Francisco
Jewell Belting Co.

HOME ELEC. CO.
934 Commerce St., Tacoma
Coffield Washing Machines

HORN CO., WM. P.
San Francisco
Grabler Mfg. Co.

HUBBARD, INC., ALEX
1710 Glenarm St., Denver
Killark Safety Fuses

HUGHSON & MERTON, INC.
9 Main St., San Francisco
Gleason-Tiebut Glass Co.
Eagle Mfg. Co.
Empire Stamping & Metal Spinning Co.
Liberty Lamp & Shade Co.

HYDRAULIC STEELCRAFT CO.
811 Hearst Bldg., San Francisco
Hydraulic Steelcraft Co.

ILLINOIS ELEC. CO.
261 S. Los Angeles St., Los Angeles
"Oamco" Reflectors
Free Sewing Machines
Apex Cleaners, Rotapex Washers
Ravencore Rubber Covered Wire
Bryant Elec. Co.
National Metal Molding Co.
Loxon Lamp Guards, Red Devil Lamp Coloring
Jefferson Elec. Mfg. Co.
Pittsburgh Rigid Conduit
Daylo Material, Columbia Dry Batteries
Chicago Fuse Mfg. Co.
Brascolites
Klein Tools
J. H. Parker & Sons, Inc.
Westinghouse Elec. & Mfg. Co.

INDEPENDENT CORDAGE CO.
Vancouver
Plymouth Cordage Co.

INDEPENDENT PNEUMATIC TOOL CO.
61 Fremont St., San Francisco
"Thor" Elec. Tools

INTER MOUNTAIN ELEC. CO.
Salt Lake City
Free Sewing Machines
Chisholm Moore Mfg. Co.

INTER MOUNTAIN ENG. CO.
Salt Lake City
Hyatt Roller Bearing Co.
Simplex Elec. Heating Co.

INTERNATIONAL DEVICES CO.
713 Flood Bldg., San Francisco
Elec. Apparatus

INTERNATIONAL ELEC. CO.
1174 Phelan Bldg., San Francisco
Heating Appliances

JEWELL ELEC. INST. CO.
Call Bldg., San Francisco
Measuring Instruments

JOHNSTON, M. A.
75 Fremont St., San Francisco
Black & Decker Mfg. Co.

JOHNSON, JOSEPH, & G. M. JOSSELYN & CO.
56 Sacramento St., San Francisco
Plymouth Cordage

JENKIN BROS.
112 Market St., San Francisco
Jenkins Bros.

JOHNS-MANVILLE, INC.
Post and Mason Sts., San Francisco; Butte, Phoenix, Salt Lake City, Seattle, Portland, Los Angeles, Spokane, Denver, Vancouver
Johns-Manville, Inc.

JONES, C. H.
Newhouse Bldg., Salt Lake City
Lakewood Eng. Co.

KAUFMAN CO., THE
327 W. Second St., Los Angeles
Retherford Lighting Fixtures

KEELER-WHITE CO.
509 Mision St., San Francisco
W. J. Murdock Co.
Mutual Elec. & Mach. Co.
"Buss Fuses"
"Beldenamel", "Beldanite" and "Beldenmold"
Appleton Elec. Co.

KLUGE, A. A.
638 S. Figueroa St., Los Angeles
Acme Apparatus Co.

KINDER, J.
606 Concord Bldg., Portland
Casey-Sheldon-Foster

KINGSBURY MACHINE WORKS
316 Rialto Bldg., San Francisco
Kingsbury Thrust Bearings

KISER, ACKERMAN GARDNER
240 S. Sixteenth St., Salt Lake City
Ajax Elec. Specialty

KRANFIELD, PAUL
1707 Franklin St., Denver
Shepard Elec. Crane & Hoist Co.

W. B. KYLE
Call Bldg., San Francisco
Riter-Conley Co.
McClintic-Marshall

KLENCK CO., F. J.
55 New Montgomery St., San Francisco
National Fibre & Insulator Co.
Waterbury Mfg. Co.

L. M. SALES CO.
1127 Lillian Way, Los Angeles
Arnold Elec. Co.

LANDES & CO.
Salt Lake City, Denver
Pawling & Harnischfeger Co.
Chain Belt Co.

LANDERS, FRARY & CLARK
Call Bldg., San Francisco
Landers, Frary & Clark

LEEKER, G. C.
Coleman Bldg., Seattle
A. S. Cameron Co.

LLEWELLYN IRON WORKS
San Francisco
Hyatt Roller Bearing Co.

LINDROOTH, SHUBART & CO.
Boston Bldg., Denver
Link Belt Pac. Co.

LINK BELT PAC. CO.
161 N. Los Angeles St., Los Angeles
168 Second St., San Francisco
Link Belt Silent Chains

LINK BELT N. W. CO.
820 First Ave., S. Seattle
First and Stark Sts., Portland
Link Belt Silent Chains

LINK BELT CO.
Portland
Hyatt Roller Bearing Co.
Link Belt Silent Chains

LOGGERS & CON. MACH. CO.
70 Fourth St., Portland
Chain Belt Co.

LOWE CO., GEORGE
Ogden
Columbian Rope Co.

LIPPINCOTT, BEAL & CO.
Sheldon Bldg., San Francisco
L. C. Smith Bldg., Seattle
Los Angeles
Detroit Twist Drill Co.
Penberthy Injector Co.

LISTENWALTER & GOUGH, INC.
326 E. Third St., Los Angeles
Blue Bird Elec. Clothes Washer
Estate Stove Co.
Royal Vacuum Cleaner

LAKEWOOD ENGINEERING CO.
733 Rialto Bldg., San Francisco
Lakewood Eng. Co.

MAIRE. GEO. H.
910 First Ave. S., Seattle
Killark Safety Fuses

MANGRUM & OTTER. INC.
827 Mission St., San Francisco
General Railway Signal Co.

MARSHALL & WELIS CO.
L. C. Smith Bldg., Seattle
Fifteenth and Lovejoy Sts., Portland
Spokane
Chisholm, Moore Mfg. Co.
General Ry. Signal Co.

McCALL, J. E.
407 E. Fifty-Fourth St., Portland
Ilg Elec. Vent. Co.

IND. PNEUMATIC TOOL CO.
Portland
Independent Pneumatic Tool Co.

McKESSON, R. F.
1055 Market St., San Francisco
Charter Oak Stoves

McCRACKEN CO., THE J.
Blake-McFall Bldg., Portland
Blaw-Knox Co.

McMILLAN, JOHN W.
443 S. Los Angeles St., Los Angeles
Northwestern Motors & Dynamos

MARINE ELEC. CO.
195 Fremont St., San Francisco
Diehl Mfg. Co.

MARINE ELEC. SHOP
62 Marion St., Seattle
Eck Dynamo & Motor Co.

MERRITT, J. M.
737 Terminal St., Los Angeles
Acorn Ranges

MEESE & GOTTFRIED CO.
660 Mission St., San Francisco
San Pedro and E. Third St., Los Angeles
556 First Ave., Seattle
67 Front St., Portland
Meese & Gottfried Co.
Standard Pressed Steel Co.
Chain Belt Co.

MEYERBERG, LEO J.
428 Market St., San Francisco
Acme Apparatus Co., Transformers

MIDWEST ENGINE CO.
Rialto Bldg., San Francisco
McIntyre Bldg., Salt Lake City
Midwest Engine Co.

MILTON MFG. CO.
524-36 Barclay Block, Denver
461 Market St., San Francisco
Hoge Bldg., Seattle
W. S. DePierris Co.

MINE & SMELTER SUPPLY CO.
Salt Lake City, Denver
"Standco" Set Screws and Steel Shaft Hangers
E. R. Ladew Co., Inc.
Hoyts Flintsone Belting
Free Sewing Machines

MODERN APPLIANCE CO.
508 First Ave., Seattle
Eclipse Mach. Co.
Delco Light Products

MODERN UTILITIES, LTD.
350-54 Water St., Vancouver
Delco Light Products

MOLONEY ELEC. CO.
Newhouse Bldg., Salt Lake City
Moloney Elec. Co.

MONARCH REFILLABLE FUSE CO.
San Francisco, Los Angeles, Seattle, Denver
Monarch Refillable Fuse Co.

MONROE CALCULATING MACHINE CO.
131 S. Main St., Salt Lake City
Central Bldg., Seattle
618 Sprague Ave., Spokane
304 Oak St., Portland
60 E. Broadway, Butte
417 Market St., San Francisco
Van Nuys Bldg., Los Angeles
Monroe Calculating Mach. Co.

MONTANA ELEC. CO.
Butte
Free Sewing Machines

MORE ELEC. CO.
Gas and Elec. Bldg., Denver
Jewell Elec. Instruments

MORGAN-ADAMSON-TANNER CO.
Templeton Bldg., Salt Lake City
Lakewood Eng. Co.

MORRIS, GEORGE
Security Bldg., Los Angeles
Shepard Elec. Crane & Hoist Co.

MOSSMAN, J. B.
Dooly Block, Salt Lake City
A. S. Cameron

MOUNTAIN STATES MACH. CO.
536 U. S. Nat'l Bank Bldg., Denver
Midwest Engine Co.
Moloney Elec. Co.

MUNNELL & SHERRILL
40 First St., Portland
Pioneer Rubber Mills

MURPHY, W. F.
415 Seventeenth St., Denver
Elec. Mach. Co.

MYERS & SCHWARTZ
75 N. Montgomery St., San Francisco
Killark Safety Fuses
Pittsburgh Reflector & Ill. Co.
Connecticut Tel. & Elec. Co.
Eagle Wood Turning Co.
S. Robert Schwartz & Bro.
Perfectlite Mfg. Co.

MERCURY AVIATION CO.
Wilshire Blvd. at Crescent, Hollywood
Beverley Hills
Pasadena
J. L. Aircraft Corp.
Nebraska Aircraft Corp.
Curtiss Airplane & Motor Corp.

NATHAN, DOHRMANN CO.
Geary and Stockton Sts., San Francisco
"Wayne" Elec. Clothes Washer

NATIONAL CASH REGISTER CO.
Seattle, Salt Lake City, Denver, San Francisco, Portland, Spokane, Phoenix, Butte, Los Angeles
National Cash Register Co.

NATIONAL SCREW & TACK CO.
519 California St., San Francisco
National Screw & Tack Co.

NEW ENGLAND ELEC. CO.
1951 Lawrence St., Denver
Crescent Insulated Wire

NEW YORK BELTING & PACKING CO.
519 Mission St., San Francisco
315 Felt Bldg., Salt Lake City
New York Belting & Packing Co.

NATIONAL CARBON CO.
599 Eighth St., San Francisco
American Ever-Ready Works

NIXON KIMMEL CO.
167 Wall St., Spokane
Jewell Elec. Instruments
Wisconsin Elec. Co.

NOLDEKE, R. S.
67 Front St., Portland
Meese & Gottfried Co.

NORTH COAST ELEC. CO.
710 Western St., Seattle
"Oamco" Reflectors
Estate Stove Co.
Crescent Insulated Wire
Safety Insulated Wire & Cable Co.

NORTHWESTERN ELEC. CO.
415 Seventeenth St., Denver
Martin Rotary Conveyors

NUESELL, G. A.
601 Central Bldg., Seattle
Truscon Steel Co.

OHIO BRASS CO.
523 Mission St., San Francisco
Los Angeles
Ohio Brass Co.

OHIO ELEC. & CONTROLLER CO.
519 California St., San Francisco
Ohio Elec. & Controller Co.

OREGON MARINE & FISHERIES SUPPLY CO.
107 First St., Portland
Plymouth Cordage

OSBORN MFG. CO.
61 First St., San Francisco
Osborn Mfg. Co.

OSGOOD & HOWELL
Wells Fargo Bldg., San Francisco
Peck-Stow & Wilcox Co.
Nicholson File Co.

OSHKOSH MFG. CO.
Hearst Bldg., San Francisco
Oshkosh Mfg. Co.

OSTIGUY, GEO. H.
1620 Fourteenth Ave., Seattle.
"American" Elec. Heating Devices

OTIS, W. I.
324 Rialto Bldg., San Francisco
Thordarson Transformers
Jiffy Cutters, Punches
Allan Stokers, Furnaces
Square Deal Switches

PACIFIC ASBESTOS & SUPPLY CO.
Portland
Clipper Belt Lacer Co.

PACIFIC MILL & MINE SUPPLY CO.
Los Angeles, San Francisco
Clipper Belt Lacer Co.

PACIFIC NET & TWINE CO.
1213-1233 Western Ave., Seattle
Plymouth Cordage
Carlisle & Finch

PACIFIC SALES CO.
718 Mission St., San Francisco
Allmur Automatic Elec. Cook Stove

PACIFIC STATES ELECTRIC CO.
Los Angeles, Seattle, San Francisco, Portland, Spokane
The American Conduit Mfg. Co.
Anaconda Copper Mining Co.
Crouse-Hinds Co.
Edison Elec. Appliance Co.
Edison Mazda Lamps
The Orangeburg Fibre Conduit Co.
Gen. Elec. Co.
Hemingray Glass Co.
Hubbard & Co.
Hurley Machine Co.
Ivanhoe-Regent Works
Locke Insulator Mfg. Co.
L. Plaut & Co.
Sprague Elec. Works
Square Deal Co.

PACIFIC TANK & PIPE CO.
910 Trust and Savings Bldg., Los Angeles
Pacific Tank & Pipe Co.

PACIFIC TOOL & SUPPLY CO.
365 Market St., San Francisco
Chisholm Moore Mfg. Co.
Stow Flexible Shafts

PANAMA LAMP & COM. CO.
595 Mission St., San Francisco
Sun-Ray Mfg. Co., Lighting Fixtures
Eclipse Machine Co. Elec. Cleaners
Tungsol Lamps

PARKER, H. L.
111 Montgomery St., San Francisco
Stanley & Patterson

PARMALEE-DOHRMANN
Los Angeles
Wayne Elec. Clothes Washer

PATTERSON DENTAL SUPPLY CO.
Spokane, Seattle, Boise
Victory X-Ray Corp.

PAWLING & HARNESCHFEGER CO.
930 Central Bldg., Los Angeles
821 Monadnock Bldg., San Francisco
Yeon Bldg., Portland
L. C. Smith Bldg., Seattle
Pawling & Harneschfeger Co.

PEIR & CO., A. H.
Higgins Bldg., Los Angeles
Lincoln Elec. Co.

PERINE MACHINE CO.
Seattle
Independent Pneumatic Tool Co.

PELTON WATER WHEEL CO.
Nineteenth and Harrison Sts., San Francisco
M. W. Kellogg Co.

PHILLIPS. G. W.
510 Colorado Bldg., Denver
Truscon Steel Co.

PIONEER RUBBER MILLS
223 S. Los Angeles St., Los Angeles
Pioneer Rubber Mills

PITTSFIELD MACHINE & TOOL CO.
A. S. Kedsie
312 Williams Bldg., San Francisco
Pittsfield Machine & Tool Co.

PITTSBURGH PIPING & EQUIP. CO.
Monadnock Bldg., San Francisco
Pittsburgh Piping & Equip. Co.

POMEROY, J. G.
833 San Fernando Bldg., Los Angeles
McGill Mfg. Co.
Rome Wire

POOLE ELECTRIC CO.
1208 Fourth Ave., Seattle
Eureka Vacuum Cleaners
Arnold Elec. Co. Vibrators

PORTER, N., SADDLE & HARNESS CO.
Phoenix
Plymouth Cordage

PRATT-GILBERT CO.
Phoenix
Blaw-Knox Co.

PREER TOOL & SUPPLY CO.
Portland
Drake Lock-Nut

PREMIER SERVICE CO.
315 Mason St., San Francisco
Elec. Vacuum Cleaners

PYRENE MFG. CO.
527 Mission St., San Francisco
Pyrene Mfg. Co.

PURDON, A.
Newhouse Bldg., San Francisco
Elec. Engin. Equip. Co.

PRICE, W. M.
Seattle
Elec. Controller & Mfg. Co,
Northwest Elec. Co.

RADIO SHOP
Bank of Italy Bldg., San Jose
Acme Apparatus Co.
RAMEY MFG. CO.
A. A. Cairnes, 539 Spokane Ave., Portland
Rayrac Elec. Cleaners
Cyclone Sawmill Blowers
REDD, J. B.
305 Kerckhoff Bldg., Los Angeles
"Stue Bing" Conveying Systems
REDWOOD MFGS. CO.
1600 Hobart Bldg., San Francisco
822 East Third St., Los Angeles
Redwood Mfg. Co.
REPUBLIC SUPPLY CO.
Los Angeles
Chisholm Moore Mfg. Co.
RICHARDS, J. LEE
508 Larkin St., San Francisco
"Whirlpool Sanitary Dishwashers"
RICHMOND, F. C., MACHINE CO.
117 West Second St., Salt Lake City
Chicago Pneumatic Tool Co., Tools
Conveyors Corporation of America
RIDDELL, A. C.
Higgins Bldg., Los Angeles
Marvin Bldg., San Francisco
Ajax Elec. Supply Co.
RINGE. W. H.
16 California St., San Francisco
Shepard Elec. Crane & Hoist Co.
RIX COMPRESSED AIR DRILL CO.
Los Angeles
Independent Pneumatic Tools
ROBBINS & MEYER
Rialto Bldg., San Francisco
Robbins & Meyer
ROBERTSON CO., H .H.
1007 Hobart Bldg., San Francisco
Pioneer Bldg., Seattle
341 Citizens' Nat'l Bk. Bldg., Los Angeles
H. H. Robertson Co.
ROLLER-SMITH CO.
589 Howard St., San Francisco
Roller-Smith Co.
RALPH MILLS & CO.
149 California St., San Francisco
Coleman Bldg., Seattle
Spalding Bldg., Portland
American Bank Bldg., Los Angeles
Penn Wire Glass Co.
SAFETY INSULATED WIRE & CABLE CO.
589 Howard St., San Francisco
Safety Insulated Wire & Cable Co.
SALT LAKE HARDWARE CO.
Salt Lake City
Horton Mfg. Co.
Denver Engineering Works Co.
S. F. COMPRESSED AIR CLEANING CO.
397 Sutter St., San Francisco
Clements Mfgr. Co.
SCHIEREN CO., CHAS. A.
257 Mission St., San Francisco
305 First Ave. South, Seattle
1752 Arapahoe St., Denver
Durbax Belting
SCOTT ELEC. CO.
Portland
Horton Mfg. Co.
SEARLES, MAILLER
126 New Montgomery St., San Francisco
Economy Tiering Machines
Matthews Gravity Carrier
Brown Portable Elevators and Conveyors
Cowan Transveyors
"Industrial" Elec. Trucks and Tractors
Durnat Productimeter
SEARS, W. L.
1912 S. G St., Tacoma
Eureka Vacuum Cleaner
SEATTLE BELTING & SUPPLY CO.
Seattle
Clipper Belt Lacer Co.
SEATTLE ELEC. SUPPLY CO.
509 Pine St., Seattle
Coffield Washing Machines
SEATTLE ELEC. WASHER CO.
Seattle
Horton Mfg. Co.
SEATTLE HARDWARE CO.
Seattle
Grinnell Washing Machine
Wisconsin Elec. Co.
SELLER & CO., M.
Portland, Seattle, Spokane
Dexter Washing Machines
Simplex Elec. Heating Co.
SHARPE, H. W.
Portland
E. R. Layden Co.
Haysts Flintstone Belting
SHOUSE, E. A.
187 Twelfth St., Oakland
Earl P. Cooper Airplanes & Motors
SHAW-PALMER-BAKEWELL CO.
Los Angeles
Stow Flexible Shafts
SHAW SUPPLY CO.
Seattle and Portland
Inter. Devices Co.
SIERRA ELEC. CO.
515 Market St., San Francisco
Dongan Elec. Mfg. Co.
Grether Fire Equipment
SIMMONS, THOS. W.
240 California St., San Francisco
Triumph Elec. Co.
SIMPLEX WIRE & CABLE CO.
612 Howard St., San Francisco
Simplex Wire
SMITH-BOOTH-USHER & CO.
50 Fremont St., San Francisco
220 Central Ave., Los Angeles
Lakewood Eng. Co.
SMITH, S. MORGAN
Sheldon Bldg., San Francisco
Smith Hydraulic Turbines
SPEARS & WELLS CO.
239 Twelfth St., Oakland
Chain Belt Co.
SPENCER, F. E.
719 Seventh St., Los Angeles
Clements Mfg. Co.
Vacuum Cleaners
Eclipse Mach. Co.
SPERRY, L. E.
126 Montgomery St., San Francisco
American Circular Loom Co.
W. N. Matthews & Bro., Inc.
New York Insulated Wire Co.
SPOKANE DRY GOODS CO.
Spokane
"Wayne" Elec. Clothes Washer
SPOKANE PAPER & STATIONERY CO.
Spokane
Columbian Rope Co.
SPRAGINS & CO.
Salt Lake City
Charter Oak Stoves
SQUIRES CO., H. B.
583 Howard St., San Francisco
Los Angeles and Seattle
Condit Elec. Protective Equipment
STALLMAN SUPPLY CO., F. O.
San Francisco
STANDARD UNDERGROUND CABLE CO.
1st Nat'l Bank Bldg., San Francisco
Standard Underground Cable
STAR MACHINERY CO.
Seattle
Valley Elec. Co.
STEARNS-ROGERS MFG. CO.
1718 Cal. St., Denver
Conveyors and Carriers
STEPHENS-ADAMSON CO.
Los Angeles
Jewell Belting Co.
STRIMPLE & COX
Seattle
Chicago Mica Co.
STUBBS ELEC. CO.
61 Sixth St., Portland
Pac. Mfg. & Elec. Co.
TALBOT, HUBBARD CO.
Phoenix
Chisholm, Moore Mfg. Co.
TAYLOR ENGINEERING CO.
Credit Foncier Bldg., Vancouver, B. C.
"Sirocco" Fans and Blowers
TEMPLE-PATTERSON CO.
Victoria, B. C.
Victor X-Ray Corp.
TERWILLIGER, H. L.
Rialto Bldg., San Francisco
A. S. Cameron Steam Pump Co.
THEDINGA, H. H.
L. C. Smith Bldg., Seattle
Moloney Elec. Co.
THOMAS CO., O. E.
406 American Bank Bldg., Los Angeles
Elec. Machine Co.
Kimble Motors
Elec. Controller & Mfg. Co.
Kuhlman Elec. Co.
THOMPSON-DIGGS CO.
Sacramento
Drake Lock-Nut
TIDEWATER CROSS-ARM & CONDUIT CO.
Tacoma
American Line Material Co.
TILTZ ENGR. & EQUIP. CO.
479 Monadnock Bldg., San Francisco
600 Metropolitan Bldg., Los Angeles
Ilg. Elec. Ventilating Co.
TINDOLPH CO., THE
1248 First Ave. S., Seattle
"Stue Bing" Conveying Systems
TRITCH HARDWARE CO.
Denver
Plymouth Cordage
TRIUMPH ELEC. CO.
1310 Seattle Boulevard, Seattle
Triumph Elec. Co.
TRUMBULL ELEC. MFG. CO.
595 Mission St., San Francisco
Trumbull Elec. Mfg. Co.
U. S. ELEC. MFG. CO.
Third St. and Central Ave., Los Angeles
U. S. Motors
U. S. RUBBER CO.
300 Second St., San Francisco
U. S. Rubber Co.
U. S. STEEL PRODUCTS CO.
Rialto Bldg., San Francisco
U. S. Steel Products Co.
UTAH MACHINE CO.
Salt Lake City
Ind. Pneumatic Tool Co.
UTAH MACHINE CO.
110 W. Second St., Salt Lake City
Pioneer Rubber Works
WAGNER ELEC. & MFG. CO.
159 New Montgomery St., San Francisco
Wagner Motors
WARD & SON, FRED
San Francisco
Wisconsin Elec. Co.
WARREN & BAILEY CO.
Los Angeles
Hoyt's Flintstone Belting
Ed. R. Ladew Co.
WASHINGTON ELEC. SUPPLY CO.
Spokane
"Oamco" Reflectors
Free Sewing Machines
WASHINGTON MACHINERY & SUPPLY CO.
309 First Ave. So., Seattle
Chain Belt Co.
Clipper Belt Lacer Co.
WATERHOUSE & LESTER CO.
540 Howard St., San Francisco
Drake Lock-Nut
"Standco" Set Screws and Steel Shaft Hangers
Wisconsin Elec. Co.
WATKINS CO., H. F.
268 Market St., San Francisco
Triumph Elec. Co.
WELCH DENTAL SUPPLY CO.
Portland
Victor X-Ray Corp.
WEST, F. E.
558 First Ave. So., Seattle
Meese & Gottfried
WESTERN AGENCIES CO.
285 Minna St., San Francisco
125 E. Ninth St., Los Angeles
923 Pine St., Seattle
"Desk Flex" Lamps
Reth-Flex Lighting Fixtures
Stahot Irons, U. S. E. Plugs
Bestov. Mfg. Co.
North American Elec. Lamp Co.
Herzog Miniature Lamp Co.
Highlands Mfg. Co.
WESTERN BELTING & PACKING CO.
1726 Wazee St., Denver
321 Occidental Ave., Seattle
Pioneer Rubber Mills
WESTERN DENTAL SUPPLY CO.
Salt Lake City
Victor X-Ray Corp.
WESTERN ELEC. CO.
680 Folsom St., San Francisco; Los Angeles, Oakland, Portland, Seattle, Tacoma
Benjamin Reflectors
Benjamin Starrett Panel Boards
Square D Safetv Switches
Faridav Bells, Fire and Burglar Alarms
Brascolites and Aglites
Duplexolites
Habirshaw Wire
Sunbeam Mazda Lamps
Crouse-Hinds Co.
Economy Renewable Fuses
Sheraduct Conduit, Flextube
Bryant Elec. Co.
X-Ray Reflectors
Edwards & Co., Inc.
D. & W. Enclosed Fuses
R. Thomas & Sons Co.
WESTERN MANNING, MAXWELL & MOORE
L. C. Smith Bldg., Seattle
40 Fremont St., San Francisco
Chisholm, Moore Mfg. Co.
WESTERN PUMP CO.
93 First St., Portland
1525 L. C. Smith Bldg., Seattle
Westco Pumps and Water Systems
WESTERN RADIO CO.
512 E. Ninth St., Los Angeles
Acme Transformers
WESTINGHOUSE PAC. COAST BRAKE CO.
Pacific Electric Bldg., Los Angeles
National Brake & Elec. Co.
Elec. Appliances
WHITE SEWING MACHINE CO.
52 Second St., San Francisco
White Sewing Machines
WHITON HARDWARE CO.
Seattle
"Wayne" Elec. Clothes Washer
WILSON, A. A.
612 S. Spruce St., Los Angeles
Coffield Washing Machine
Horton Mfg. Co., Ironing Machines
Eureka Vacuum Cleaner
WILLIAMS CO., J. H.
M. Howard, Monadnock Bldg., San Francisco
Drop Forgings and Drop Forged Tools
WIRELESS SHOP
511 West Washington St., Los Angeles
Acme Apparatus Co.
WOLFF MFG. CO.
Denver
Jewell Belting Co.
WORDEN CO., INC., W. H.
Seattle
Clipper Belt Lacer Co.
WORTHINGTON PUMP & MACHINERY CO.
435 Seventeenth St., Denver
209-210 Higgins Bldg., Los Angeles
113 W. Second South St., Salt Lake City
306 Sharon Bldg., San Francisco
203 Maynard Bldg., Seattle
Worthington Pump & Machinery Co.
ZIESEL, CO., LOUIS J.
216 Market St., San Francisco
Rester Self-Fluxing Wire Solder
ZION'S CO-OPERATIVE MERCANTILE INST.
Salt Lake City
Jewell Belting Co.